THE COMMODITY YEAR BOOK

Master Edition

Printed in the United States of America

COMMODITY RESEARCH BUREAU, INC.

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A private organization devoted to the dissemination of accurate information on commodities and other related subjects.

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MASTER EDITION

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This "Master Edition" of the Commodity Year Book series was prepared as a result of a definitely indicated need for an up-to-date commodity encyclopaedia. This need was expressed fragmentarily in the form of countless requests for information from individuals and institutions. From these requests the editors were able to obtain a very good idea of exactly what type of information was needed by the greatest number. The finished result is this volume, designed for permanent reference use.

It will be noted that preceding volumes of the Commodity Year Book series, namely the 1939, 1940 and 1941 editions, were respectively confined to discussions on background, processing and marketing of the 75 important basic commodities, together with comprehensive statistical sections on each. Those who are interested in the up-to-date statistics on the tables contained in the afore-mentioned Year Books are referred to COMMODITY STATISTICS, the 1942 Commodity Year Book, a separate volume published in October, 1942, which continues the Commodity Year Book statistical series.

However, the "Master Edition" has gone considerably further than any of its predecessors, endeavoring to cover virtually all the important raw and semi-finished products that serve to make up our national economy.

In preparing each individual story, an attempt was made to use the same general outline for all, namely covering such points as physical description, method of production and area of origin, principal uses and finished products, marketing and transportation methods, comparative prices in recent years, perishability, principal types and grades, possible substitutes, government regulations, import duties, etc. Many of the commodities did not lend themselves to this specific type of treatment, but, in the main, every effort was made to follow a similar outline throughout the contents.

With our country at war, certain information, notably production figures on strategic and essential commodities, must be withheld from publication. In this respect, figures on production volume are those which have been officially released by government and quasi-official sources.

In order to compile the up-to-date factual information on the hundreds of products covered in the following pages, it was necessary to seek the

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cooperation of leading industrial organizations, trade associations, government agencies and individual experts in the various fields. This assistance was readily forthcoming and we wish to thank all those who gave their unselfish cooperation in this important educational effort. They have been listed on the pages immediately following.

We trust that you will find in this volume the answers to most of the basic questions that arise in regard to commodities.

THE EDITORIAL BOARD

September, 1942

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Abaca

See Manila Hemp

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Acacia

A GENUS of woody plants of warm regions, belonging to the Mimosa family. Usually bearing white or yellow flower clusters. Many of the species yield valuable gums and tanning extracts, while at least one of India is the source of a coarse fiber. In Australia, all Acacia trees and shrubs are called wattle. See catechu, cutch, wattle, gambier.

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Acetanilide

ACETANILIDE is also known under the names of monoacetylanilin, phenylacetamide, and antifebrin. It occurs as white, shining crystalline scales or a white, crystalline powder, is odorless, has a slightly burning taste, and is stable in air. Industrially it is produced by heating aniline and glacial acetic acid in a steam jacketed enamel still until tests show no uncombined anilin. The excess acetic acid is then distilled off under vacuum. The crude acetanilide crystallizes upon cooling, is centrifuged out, and then purified by recrystallization from boiling water.

Commercial grades of acetanilide include a technical, 95 percent grade and a medicinal grade. Production of the technical grade in the United States during 1940 amounted to 398,833 pounds, manufactured by five companies. Production of the medicinal grade in the same year was 735,568 pounds, with four plants making the material. The two grades of acetanilide are packaged in barrels containing 200 or 150 pounds; in fiber drums or cartons containing 100, 50, 25, and 5 pounds, and in one-pound boxes and bottles.

The uses of acetanilide are in medicine, for its analgesic and antiseptic qualities; as a preservative or stabilizer for hydrogen peroxide; as a stabilizer for hydrogen ester coatings; in the manufacture of intermediates, photographic developers, and pharmaceutical chemicals. The price of technical acetanilide on June 1, 1942 ranged from 27 to 29c per pound; while the medicinal material was priced at from 34 to 36c per pound. In both cases the powdered form was cheaper than the crystalline material. The price of the medicinal grade of acetanilide on January 1, 1942 and January 1, 1941 was between 30 and 32¢ per pound. Under the provisions of the United States food and drug law, the presence of acetanilide in pharmaceutical preparations must be stated on the label.

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Acetic Acid

ACETIC acid is a water-white, mobile liquid at normal temperatures; liquid solidifies at 60°F., hence the term "Glacial" for strengths of 99% and 99.9% purity. It has a pungent odor and is corrosive to the skin, therefore requiring a white label under railroad shipping regulations. It is produced synthetically and by the destructive distillation of wood. Approximately 225 million pounds are produced in the United States annually. Principal uses are in acetate solvents and salts, cellulose acetate, the textile industry, dyes, medicines, white lead, photography, cleaning compounds, industrial chemicals, etc. It is marketed in tank cars of 69,000 pounds net; and in 450 and 900-pound drums, 420 pound barrels, 100 pound carboys, and in various sizes of cases and bottles. Approximately 80% of the acetic acid consumed in the country is shipped in the form of Glacial Acetic Acid in tank cars, a large part of which is repacked into drums, carboys, etc., for redistribution to the trade.

Various strengths used are: 28%, 56%, 70%, 80%, 84%, 85%, 90%, etc. These various strengths are made by diluting the Glacial acid with pure water to the desired strength. The diluted strengths have a property of freezing at much lower temperatures than the Glacial strength and are generally not as corrosive. Prices vary with the strength. The ceiling price on Glacial Acetic Acid is 6.93¢ per pound f.o.b. works. There is an import duty of 1¢ per pound. Three principal grades, exclusive of the diluted acid, are: Glacial Acetic Acid 99% or higher; U.S.P. Glacial Acetic Acid 99.5% or higher; and C. P. Glacial Acetic Acid 99.8% or higher.

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Acetic Ether

See Ethyl Acetate

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Acetone

ONE of the more important of the industrial solvents, acetone, is used in the manufacture of smokeless powder, and in countless hundreds of other processes directly or indirectly connected with our war materials.

It is a colorless, inflammable liquid (CH_3COCH_3), soluble in water, ether, chloroform and most volatile oils. With a specific gravity of .79, it boils at 56° C. It contains not less than 99 percent dimethyl ketone by weight. It is miscible with distilled water in all proportions.

It is obtained by the fermentation of grains, with butyl alcohol and acetone resulting. Formerly, it was obtained chiefly as a by-product from the wood distillation industry. The bacterial fermentation process was the outgrowth of the need for a better quality product for the manufacture of explosives in World War I. Corn was first used as a raw material but later developments permit the use of practically any carbohydrate material. Currently, a greater quantity of wheat is destined to be employed in the production of alcohol and acetone.

Acetone is an exceptionally active solvent for a wide variety of organic materials—gases, liquids and solids. Among the materials readily dissolving in acetone are acetylene, asphalt, camphor, cellulose acetate, cellulose nitrate, ethyl cellulose, chlorinated rubber, dyes, fats, greases, gums, tanning extracts, vegetable oils, vinyl and methecrylate resins, photographic film, and cellulose acetobutyrate. It is completely miscible not only with water but also with most organic liquids. It acts as a common solvent, or coupling agent, for many otherwise immiscible liquids. In the extraction of essential oils, medicinal principles, and such it finds wide use and, because of its volatility, can be readily removed from the finished product. It is a precipitant of waxes, enzymes, and certain other materials and is useful in many refining and purification processes, such as the dewaxing of lubricating oils, the reactivation of spent filter clay, and the processing of latex and crude rubber. One of the largest uses of acetone is in the manufacture of rayon and films based on cellulose acetate.

Manufacturers of cellulose ester dopes, plastics, and cements are large users and it is also an important ingredient of paint and varnish removers, as well as the basic material for the manufacture of a number of organic chemicals, including iodoform and chloroform. It is an authorized denaturant for ethyl alcohol and due to its ability to absorb large quantities of acetylene under pressure, is employed in cylinders of acetylene gas used for welding and lighting purposes.

It is marketed in 55 gallon drums weighing about 350 pounds.

Government activities to insure a sufficient supply of industrial alcohol, including its

restriction on the beverage distilling industry, have helped to assure a supply of acetone believed to be sufficient for all essential war needs. The Commodity Credit Corporation has made available considerable quantities of surplus corn and wheat and synthetic producers have expanded their facilities for alcohol production.

The maximum price for acetone, as fixed by the Office of Price Administration, January 1st, 1942, was 15.8¢ per pound, delivered, tank cars in eastern territory (which means the States of New Mexico, Colorado, Wyoming and Montana and all states east thereof). In drums, carload lots, the price was 16.8¢ and in drums, less than carload lots, 17.3¢ per pound. The prices applied whether produced synthetically or from the fermentation of molasses, corn, or other raw material.

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Acetyl Salicylic Acid (Aspirin)

FOR 1941, United States government figures disclosed production of 6,200,000 pounds of aspirin, made synthetically by five companies from salicylic acid and acetic anhydride. The acid is 99.5-99.9% pure, and is usually marketed compressed into 5 grain tablets. It is also available in pure powder form and as a granulation containing up to 20% starch. In appearance the powder is white. It decomposes in moist air into salicylic and acetic acids. It is stable in dry air. There is no odor and it is crystalline in structure. Heating to 135° will melt the acid. It is interesting that while one gram (15.4 grains) will dissolve in 300 cc of water, only 5 cc of alcohol, or 17 cc of chloroform, or 10-15 cc of ether are needed to dissolve a gram. The powder or tablets are decomposed by boiling water or when dissolved in solutions of alkali hydroxide and carbonates. In medical terms, for that reason, the acid is rated incompatible with alkalies, bicarbonates, potassium or sodium iodine.

The word "analgesic," describes the properties of the acid—in simple words a "pain killer." While the powder is marketed in drums, barrels and smaller containers, the tablets are distributed either in bottles of various size or in metal pocket packages.

The price for powder is quoted at 40¢ per pound while tablet prices vary with the maker.

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Acetylene

ACETYLENE is a colorless, flammable, non-toxic gas. Chemically pure acetylene has a pleasant, ethereal smell but slight impurities in the commercial product give it the characteristic odor that is helpful in the detection of leaks. The explosive range of acetylene-air mixtures is from about 2.5 per cent to 80 per cent acetylene.

Commercially, it is obtained by the action of water on calcium carbide, one pound of which yields about 4.5 cu. ft. of acetylene, producing calcium hydroxide as a by-product.

With copper and silver, acetylene forms explosive compounds and for that reason acetylene should never be brought into contact with unalloyed copper or silver except in a blowpipe tip.

At pressures in excess of 15 lbs. per sq. in. gauge, free acetylene may decompose violently. To eliminate this decomposition tendency acetylene cylinders are provided with a porous mass that completely fills the cylinder and which has voids of very minute size. To permit placing a fairly large amount of acetylene into a relatively small space, the voids are partially filled with acetone into which the acetylene is actually dissolved, acetone having the desirable property of dissolving about 25 volumes of acetylene for each volume of acetone and for each atmosphere of pressure.

Acetylene being an unsaturated compound, can be used as a raw material in the synthesis of a large number of compounds such as acetic acid and butadiene.

Acetylene is used principally mixed with oxygen (oxy-acetylene) in specially designed blowpipes for the welding and flame-cutting of metals. The flame temperature of the oxy-acetylene flame is approximately 3500 deg. C. (6300° F.)

Because of its high luminosity the acetylene-air flame is used to a considerable extent in home lighting, marine buoys, miners' cap lamps and railroad car inspectors' lanterns. A suitable burner consuming one cubic foot of acetylene per hour will produce a light of about 45 candle power.

Prices vary according to delivery zone and quantity. In July 1942 oxygen was priced at $1.75 per hundred cubic feet and acetylene at $3.25 per hundred cubic feet—on a small-lot basis. Cylinders remain the property of the gas manufacturing company and are returnable promptly.

* * *

Aconite

The basis for crystalline aconitine, used in medicine as a cardiac sedative and local anodyne, aconite is the dried tuberous root of Aconitum napellus, especially Monkshood, found in the mountainous regions of Europe, Asia and North America.

The crystalline product, an alkaloid, is white, colorless and odorless — a violent poison. The root is the basis for various aconitines.

In July 1942, aconite leaves, in barrels were quoted at $1.40-$1.45 per pound while the root in barrels was priced at $2.50-$2.55. Aconitine, amorphous, in bottles was priced at $23.00 to $28.00 per ounce while 15-gram vials were offered at $1.00 each. Crystalline aconitine in bottles was quoted at $42.00 to $48.00 per ounce while that product in 15-gram vials was priced at $1.60.

Aconitine is violently poisonous—in either the crystalline or amorphous form.

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Aconitine

See Aconite

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Acrylic Resins

See Plastics

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Adhesives

See Plastics

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Agalite

See Talc

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Agar Agar

A gelatinous substance extracted from various species of seaweed (red algae) found in the Pacific and Indian Oceans and the China Sea. It is known as Japan Agar; and as Ceylon, Chinese, or Japan Isinglass or Gelatin.

It is obtained by boiling the seaweed and then straining out the insoluble matter. Although insoluble in cold water or in alcohol, it is slowly soluble in hot water. A one-per-cent solution in water forms a stiff jelly on cooling.

Commercial agar agar is colorless, yellowish or pink to black and is marketed in long, transparent, odorless, tasteless strips or as a powder of varying degrees of fineness.

It is used in medicine, chiefly as a cathartic, for fixing bacteria for counts, and is taken as a food. Industrially it enters the

manufacture of photographic emulsions, and is used as a substitute for gelatin, isinglass, and like products. Other uses are in thickening cream and milk, in confectionery; and as a sizing for silks and paper, dyeing and printed fabrics and textiles; also in adhesives.

In June 1942, the No. 1 grade of agar agar was priced at $4.75 to $5.00 per pound while agaric was nominally quoted at $5.50.

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Agate

KNOWN commonly for the beautifully colored marbles of boyhood, agate appears in many colors, arranged in stripes or bands or blended in cloud effects, or revealing moss-like forms.

Some of the named varieties are, fortification, agate and moss agate.

It is a natural mixture of crystalline and colloidal silica. Usually, agate contains about 98 percent silica with coloring imparted to the stone by metalic oxides.

The stone is used for knife edges and bearings of instruments, as well as for pestles and mortars. Finer specimens are sold as gem stones and the stone also enters into the production of a variety of ornamental goods.

Uruguay and Brazil are the source of the largest and best quality agates but Germany has been the center of production. Moss agates of Montana are employed as gem stones. Artificial staining of commercial agates with mineral oxides or salts or treatment with acid are common practices used to enhance the color differences.

A considerable amount of moss agate has been recovered from the gravels of the Yellowstone River in southeastern Montana. This source has long furnished beautiful moss agate for jewelry, but fine material is becoming scarce. The deposit in Granite Hills near Split Rock, Wyoming also supplies considerable moss agate, and some is produced in other mountain states.

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Agave Fiber

THE general name applied to a variety of valuable fibers obtained from a large and important genus of plants of the amaryllis family occurring in tropical America and the United States. From Agava sisalina and its allies come sisal and henequen. Pulque, a fermented drink of Mexico, is made from the juice of various species of the Maguey type while mescal, a small cactus (Agave atrovirens) is used especially by the Mexican Indians as a stimulant and antispasmodic. Several varieties possess detergent properties and are known as amoles, or soap plants.

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Alabaster

ALABASTER is a compact variety of gypsum, of fine texture. The name is sometimes employed for a hard compact variety of calcite or, rarely, aragonite, sometimes transluscent and many times beautifully banded.

In color, alabaster is usually white but sometimes yellow, red or gray. It is carved into vases and other ornaments.

United States imports of alabaster manufactures were valued at $203,824 in 1937; $159,551 in 1938; $110,136 in 1939 and but $69,820 in 1940. (*See gypsum.*)

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Albacore

See Tuna

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Alberene

See Talc

Albumin

THE term Blood Albumin is often used loosely to cover any type of soluble dried blood or dried component parts thereof. Technically, Blood Albumin should refer only to the serum of blood generally dried to a light colored product but occasionally sold in liquid form. The blood is collected from slaughtered animals in the packing houses and separated into plasma and hemoglobin. The plasma is then defibrinated to prepare the serum for drying. (Hemoglobin can be dried down to an acceptable ingredient in feeds and fertilizers.)

Principal uses are: (1) Manufacture of leather finishes and glazing; (2) A mordant in fixing textile dyes; (3) An adhesive to bind cork inserts to metal bottle caps.

Marketing is in veneer drums, pan dried, 290 lbs. net; powdered, 200 lbs. net. The price in May, 1942, was 65¢ per lb. compared with 60¢ a year previous.

This product remains stable for about one year under normal storage conditions. After that, insolubility may occur and tend to increase progressively. Substitutes are egg albumen, resin and casein. The duty is 12 cents per pound for imports. These were principally from Austria before the war.

* * *

Alcohol (Industrial)

BUREAU of Internal Revenue Regulations No. 3 defines Industrial Alcohol as "that substance known as ethyl alcohol, hydrated oxide of ethyl, or spirits of wine, from whatever source or process produced, having a proof of 160 degrees or more, but does not include the substances commonly known as whisky, brandy, rum, or gin, or other spirits, produced at registered distilleries or fruit distilleries operated under Bureau of Internal Revenue Regulations 4 and 5." Industrial Alcohol may be sold either in its pure state or denatured for specific industrial uses.

It is produced by fermentation of sugar solutions. Starch may be broken down to sugar. Generally speaking, any material containing fairly high amounts of starch or sugar may be used as a raw material. Present production methods utilize molasses, corn, and other grains. A considerable quantity of the whole country's output also comes from synthetic production.

Since the sugar content of molasses can be easily and economically converted into alcohol, it has been used for a large portion of the ethyl alcohol produced in this country. Blackstrap molasses, a by-product of cane sugar mill operations, containing between 50% and 60% of sugar by weight, is the principal source.

The sugar in blackstrap molasses is present in different chemical forms. Generally the greatest percentage is sucrose, having a chemical formula $C_{12}H_{22}O_{11}$. Sugar of the glucose of grape sugar type (invert sugars), having the chemical formula $C_6H_{12}O_6$, is also present.

In the fermentation process the sugars are converted into alcohol by the action of yeast enzymes. The molasses is made up into a mash by mixing with a calculated amount of water so that the final sugar concentration falls within the range of 10% to 20% by weight. Yeast is prepared in special equipment to insure a pure, vigorous culture and is added to the mash in quantities ranging from 3% to 10% by volume. The acidity of the mash is regulated carefully to control the action of impurities in the mash upon the yeast and yet permit rapid conversion of the sugars to alcohol.

The yeast has a double action upon the sugar, brought about by the presence in the yeast of two enzymes, invertase and zymase.

During the fermentation process the temperature is very carefully regulated. At times, depending on the particular characteristics of the molasses used, it is necessary

to add a small amount of nutrients to the mash to sustain the activity of the yeast. The time required to convert the sugars to alcohol, with maximum yields, varies between 36 and 48 hours. The yeast itself does not undergo change during the process but merely acts as the agency for conversion of sugar to alcohol.

The resulting mash, at the completion of fermentation, contains from 6% to 12% alcohol and is called "beer."

The "beer" is passed into a continuous distilling unit and the alcohol separated from the residue or "slop," by distillation with steam. While alcohol is the main product of yeast activity, small quantities of other substances are produced, such as aldehydes, esters and fusel oil which distill over with the alcohol. These substances do not decrease the solvent powers of the alcohol but they impart a distinct odor which is undesirable. Also, they have value as by-products in their purified form. It is, therefore, necessary to rectify the crude alcohol by re-distillation. This method of purification has been developed to a high degree and alcohol (before denaturation) is one of the purest chemicals.

Among the by-products recovered from the fermentation process are carbon dioxide (compressed either to a liquid or a solid), potash for the manufacture of fertilizers, vitamin concentrates for feedstuffs, and binders for the foundry and coal processing indutries.

The use of grain in the production of alcohol has increased considerably as a result of the war.

The use of starch, in the form of grain, as a raw material for alcohol fermentation dates back to very ancient times. Starch is not directly fermentable by yeast and must therefore be first converted to sugar. The procedure is to cook the starch (grain), cool, and then treat with barley malt, whose diastatic enzymes convert substantially all of the starch to sugar.

In fermentation the most outstanding difficulty to contend with is infection. Its control, for the most part, rests on a single factor in the solution, namely, its acidity. If the pH is kept down to 5 or preferably a little below, most of the infecting organisms are strongly held back in their growth and the resulting fermentation is essentially a pure culture yeast fermentation. The usual method of accomplishing this in grain solutions is to acidify by the use of lactic acid.

A major development in the field of fermentation of starchy materials was made in 1898 by Calmette of France. It depends on the use of mold to replace the malt of the ordinary fermentation procedure. This process had its origin in a study made by Dr. Calmette of the so-called "Chinese Yeasts." The molds are able to saccharify starch rapidly, and the combination of yeasts and molds thus carries out the two steps of conversion of starch to sugar and of sugar to ethyl alcohol by their combined activities in the mash. This method, called the Amylo process, has been developed industrially in several countries.

Synthetic ethyl alcohol may be produced by a number of different methods. Over a century ago, Hennel, collaborating with Faraday, discovered that it was possible to combine the ethylene present in illuminating gas with sulphuric acid, and that the compound formed could be decomposed in a manner to yield ethyl alcohol. It is also possible to combine ethylene with water, in the presence of a catalyst, to produce ethyl alcohol direct. Another method is to chlorinate ethane to form ethyl chloride, which is then hydrolyzed with caustic soda to produce ethyl alcohol and sodium chloride. Synthetic alcohol may also be produced from acetylene by conversion into acetaldehyde, which is then in the presence of catalysts, hydrogenated to ethyl alcohol.

Many problems, involving the separation and purifying of the gases preliminary to

processing, have had to be solved. It has also been necessary to segregate the various components of the rather complex mixture that results from the processing reaction. These problems have now been substantially worked out and the production of synthetic ethyl alcohol has attained commercial stature.

Alcohol is produced mainly along the Atlantic Seaboard and Gulf Coasts and in the Middle West. Comparatively small amounts are produced on the Pacific Coast. The duty on imported alcohol makes it prohibitive. During the year ending June 1941, the U. S. Treasury Department reported production at 157 million gallons of 190°.

Industrial Alcohol finds its way into practically every industry and every finished product. Principal industries using Industrial Alcohol are:

Smokeless powder and explosives
Lacquer, lacquer thinners, & solvents
Nitrocellulose
Chemicals
Vinegar and food products
Pyroxylin and pyroxylin plastics
Shellacs, varnishes, and paints
Ethyl acetate
Drugs and medical supplies
Artificial silk
Petroleum oils
Solvents
Rubbing alcohol
Tobacco and tobacco solutions
Ether
Photographic supplies
Hair tonics
Liniments and lotions
Toilet waters
Leather and leather solutions and substitutes
Toilet preparations
Antiseptic solutions
Resins and synthetic resin materials
Hospitals

Industrial alcohol is measured and sold in terms of proof gallons and/or wine gallons. A wine gallon of 190-proof alcohol is equal to 1.9 proof gallons.

Shipment is in tankcars, 55-gallon steel drums, 50-gallon wooden barrels, 5-gallon steel or tin containers, 1-gallon and smaller containers. Transportation is via freight, express, truck, or water.

Except for certain denaturants, Industrial Alcohol is not perishable.

The principal types are:

Pure Ethyl Alcohol
Proprietary Solvent Grade Alcohol
Specially Denatured Alcohol
Completely Denatured Alcohol
Proprietary Anti-freeze Solutions.

Alcohol, being a basic chemical, has very few if any substitutes.

There is an Internal Revenue tax of $4.00 per proof gallon on Pure Ethyl Alcohol withdrawn for use by other than hospitals, educational or scientific institutions or by government agencies. Tax Free Pure Ethyl Alcohol and Specially Denatured Alcohol are sold free of tax only under Federal permits. All transactions in Industrial Alcohol are in accordance with Bureau of Internal Revenue Regulations No. 3.

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Alfalfa

ALFALFA is a leguminous forage plant grown principally for hay. It means "best fodder" in Arabic. Its remarkable adaptability to various climates and soils causes it to be widely distributed throughout the world. Although much moisture is needed to produce profitable yields, it does best in a relatively dry climate where irrigation water is available. It can survive a long period of drought but is not very productive under those conditions. A humid climate is not favorable for the growth of alfalfa. One of the reasons is that dry weather is needed to cure the product. Moreover, heavy precipitation tends to develop

acid soils while plant diseases are more destructive in humid regions.

Production of alfalfa hay in 1941 amounted to 32.3 million tons. Leading producing states are California, Minnesota, Wisconsin and Iowa. The marketing unit is the ton. Prices received by farmers in March, 1942, averaged $12.99 per ton. Transportation is by rail and truck. The duty on hay is $5 per short ton and $2.50 from Canada. The duty on alfalfa seed is 8¢ per lb. and 4¢ per lb. from Canada.

This forage plant is known as "lucerne" in Europe and in England is often called "purple medic."

★ ★ ★

Alkyd Resins

See Plastics

★ ★ ★

Alkyd (Resin)

ALKYD is a synthetic resin produced by the reaction of polyhydric alcohol with a diabasic acid and chemically extending the product, mainly with oils or fatty acids from oils. In some cases, modifiers are added. It is produced at the rate of hundreds of millions of pounds annually, largely in the United States. Its principal use is as a binder in surface coatings, such as paints, varnishes, lacquers, printing inks, textile and paper finishes and allied products. It is priced at about 30¢ per pound on a 100% (non-volatile) basis and it is marketed in cans and in 50-gallon steel drums, as well as in tank cars. If the containers are airtight, it will keep indefinitely. The two important grades are "Pure" and "Modified." While there are no exact substitutes to serve all uses, in some cases, special varnishes, involving other types of synthetic resins, cooked in oils, may be used. Some of the natural resins, too, can be employed as substitutes for many purposes.

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Alligator Skins

See Reptile Skins

★ ★ ★

Almonds

ALMONDS are the fruit of the almond tree, native to western Asia but cultivated extensively on a commercial scale in California. Various types are bitter, sweet, hard shell, soft shell, and paper shell. Bitter almonds, grown in the Mediterranean countries, are used for manufacture of flavoring extracts. Sweet edible varieties are cultivated in southern Europe and California, eaten as nuts or used in the baking and confectionery trades. They also yield an oil and are frequently ground to paste or powder.

Before the war imports came in some volume from Spain and Italy. No import figures for 1941 are available, but in 1940 1,900 tons of shelled almonds were imported.

The principal commercial grades of the domestic are Nonpareil, IXL's, Ne Plus Ultras, Drakes, and Peerless. Shelled are marketed as Jumbos, Large, Large Mediums, and Sheller Run.

The domestic crop for 1940 was 6,000 tons, this being a sub-normal yield. The crop in 1940 was 10,200 tons, that of 1939 19,-200 tons, and the peak crop of record, 20,-000 tons, was in 1937.

Commercially, almonds are bought largely by the baking and confectionery trades, and by roasters, who package roasted shelled almonds. Considerable quantities are marketed direct to consumers through fruit and grocery store channels.

The unit of purchase from the grower is the pound. Unshelled almonds are packed in 100 pound bags and some in 25 pound boxes; the shelled are packed in 25-pound wood or fibreboard boxes. Sheller run shelled are packed in 160-lb. bales. Shelled nuts for

the consumer trade are packed in various sized small bags or containers.

Normally, California almonds are shipped eastward by the intercoastal steamship lines. Due to the shipping shortage, movement is now all-rail.

Opening prices which governed the sale of the 1941 crop were: In the shell, Nonpareil, 50 cents per pound; IXL, 48 cents; Ne Plus Ultra, 48 cents; Drakes, 40 cents; Peerless, 40 cents; Shelled, Sheller Run, 95 cents; all other grades, 97 cents; prices f.o.b. California packing point.

Almonds require cool storage for both nuts in the shell and the shelled article.

While there is no commonly accepted substitute for almonds, other nuts are used in their place commercially when substitution is advisable or necessary.

Import duties are 18½ cents per pound for blanched, roasted, prepared, or preserved almonds; 16½ cents per pound for shelled; 5½ cents per pound for unshelled.

Almonds come under the General Maximum Price Regulation.

* * *

Aloe

USED in medicine mostly as a cathartic, aloe is obtained from the juice of the leaves of certain aloe plants, cultivated in South Africa, Curacao, and the Island of Socotra.

The juice before being marketed is thickened by evaporation to a thin paste which is allowed to harden. All the aloes contain resin, emodin and some volatile oil. According to the Merck Index, Socotrine and Curacao Aloes contain not less than 50% water soluble matter while Cap Aloe has not less than 60%.

Production of aloes in Curacao in the first quarter of 1942 fell to a new low—only 100 cases of 125 pounds each while exports of but 200 cases during this period were also below normal. In the first three months of 1941, Curacao production amounted to 600 cases while exports were 300 cases.

The marked decrease in production was attributed in part to the expanding petroleum industry in Curacao and Venezuela which is drawing labor from other fields with its attractive wages.

Although, as mentioned above, varieties of aloe grow in parts of Africa and South America, the United States depends chiefly on the Netherlands West Indies for its supply of this raw material.

In mid-1942, Curacao aloes were quoted at $65.00 per 100 lbs., while the Socotrine variety was priced at $65.00 to $70.00 per 100 lbs.

* * *

Alpha Terpineol

See Turpentine and Rosin

* * *

Alums

THE alums are white or colorless crystalline substances. They are odorless and have a sweetish, strongly astringent taste.

Aluminum potassium sulfate, $K_2SO_4.Al_2(SO_4)_3.24H_2O$ (potash alum or potassium alum) is used both medically and commercially. Medically, it is listed in the U.S.P. standards under the alumens, and is known as potassium alum. Technically, it is sometimes known as alum flour, alum meal and cube alum. It is soluble in water but insoluble in alcohol. It is used in the dyeing industry as a mordant; in the manufacture of lake pigments; in the treating of skins; in sizing paper; and in the production of fireproofing and waterproofing materials. In most of its applications, however, it is being replaced by aluminum sulfate, the use of which is considered more economical. It is marketed in barrels of varying weight, in

100-pound fiber drums and in 200-pound bags.

Aluminum ammonium sulfate, $(NH_4)_2SO_4.Al_2(SO_4)_3.24H_2O$ (ammonium alum) is also used medically under U.S.P. standards as ammonium alum. Technically, it is available in granular, lump or powdered form. It is used in dyeing as a mordant; in the tanning of leather; in the manufacture of baking powder; and in the printing and dyeing of fabrics.

Aluminum sulfate, $Al_2(SO_4)3\text{-}14H_2O$ (sulfate of alumina) contains 17 per cent Al_2O_3. Technically, it is sometimes known as pearl or filter alum. It is used in the manufacture and sizing of paper; in the manufacture of aluminum soaps; as a general clarifying agent in the treatment of water, fats and oils; in fire extinguishing fluids; as a mordant for dyeing; and in the manufacture of lakes. It is marketed mainly in bulk and in 100-pound bags.

There are two grades of aluminum sulphate marketed commercially. The first contains all of the insolubles originally present in the raw bauxite, from which aluminum sulphate is made.. The second has been filtered for crystallization so that essentially all insoluble material is removed. The insoluble free aluminum sulphate is generally used for paper mills and the materials from which the insoluble has not been removed is used for water treatment plants.

An iron-free aluminum sulphate is also marketed.

Burnt alum is either dehydrated aluminum potassium sulfate, $K_2SO_4.Al_2(SO_4)_3$, or aluminum ammonium sulfate, $(NH_4)_2SO_4.Al_2(SO_4)_3$. It is a porous friable product which readily absorbs moisture from the air. Medically, it is used under U.S.P. standards as exsiccated alum.

Alum (ammonia) is priced at $4.25 per hundredweight for lump, $4.00 per hundredweight for granulated and $4.40 per hundredweight for the powdered grade.

Alum occurs in natural form in the mineral, palinite.

★ ★ ★

Aluminum

ONE of the most sparkling chapters in industrial history is the sudden surge of aluminum to world usefulness in less than half a century. While the development of all our other common metals took thousands of years to accomplish, aluminum, at present the world's fifth-ranking metal in tonnage, was discovered a little over a hundred years ago, and for all practical purposes, had its actual beginning in 1886.

In that year a 22-year old Oberlin College graduate, Charles Martin Hall, discovered an inexpensive method of reducing aluminum oxide to metallic aluminum—a feat that had stumped the world's greatest scientists for years. Hall, only nine months out of college, had labored diligently to find a method of reduction that would topple a metal of so many apparent uses from the prohibitive price at which it was then selling. In 1886 little more than 35,000 pounds of aluminum were produced, and the price was $8.00 a pound. In 1938, thanks to Hall's discovery, about 300,000,000 pounds were produced. Today, because of the exigencies of war, that figure has been multiplied many times over, and the cost of the metal is 15 cents a pound.

Hall's discovery, and a similar one at about the same time by the French Paul Héroult, climaxed decades of research that started in 1825 when the Danish scientist, Hans Christian Oersted, discovered aluminum when he succeeded in isolating a small bit from the ore by a chemical process.

Frederick Wöhler, a German experimenter, repeated Oersted's tests in 1827, but it was not until 1845 that any physical properties of the metal were discovered. In that year Wöhler succeeded in extracting enough

of the metal to be worth weighing. Wöhler was the first to find that aluminum was light, and the first to isolate enough material to make a scientific study of its physical properties.

Tales of this new, light metal reached the ears of Napoleon III of France, who immediately thought of using it to outfit his armies. The value of light military equipment for an extensive armed campaign was not lost on Napoleon. Since the price of aluminum was $545 a pound at that time, the Emperor commissioned Henri Sainte-Claire Deville to experiment further. The scientist, aided by sufficient government-provided funds, improved a process that he had discovered some time before, but after four years of work could produce only 4000 pounds of aluminum annually, and that at a price of $17 a pound. While Sainte-Claire Deville failed to produce sufficient aluminum at a price low enough to outfit Napoleon's army, his work was invaluable in laying the foundation for future commercial uses of the metal, and for further study of possible reduction methods.

The next important step in the history of aluminum was Hall's discovery. The young Ohioan's success came after he abandoned aluminum reduction experiments with chemical processes, and turned to electricity as the best means of getting metallic aluminum from the aluminum oxide. After dissolving the oxide in a container filled with molten cryolite, Hall passed an electric current through the mixture and found that the long-sought aluminum settled to the bottom of the crucible. Thus, on February 23, 1886, was a cheap method of making aluminum discovered. With the discovery came the start of a modern saga of industrial research and development, as the fiction-like growth of the aluminum industry got under way.

Two years after Hall's discovery, following several unsuccessful attempts to interest backers in the process, the scientist found an eager supporter in Captain Alfred E. Hunt, who with five business associates formed The Pittsburgh Reduction Company, and began to manufacture aluminum late in 1888. In 1907 the organization took on the name it bears today—the Aluminum Company of America. Meanwhile, Héroult had failed to interest any French group in his discovery, and finally secured the financial support of a group of business men in Switzerland.

The actual production of metallic aluminum has its beginning in a material called bauxite, the only ore used commercially in the United States in the production of aluminum. Despite the fact that 8% of the earth's surface consists of aluminum, the metal is never found in the native state, but is always closely combined chemically with other elements. Bauxite contains aluminum in the form of aluminum oxide chemically combined with water. The ore may be like rock, or as soft as mud. In addition, it contains a number of impurities, which cause the ore to occur in various colors and textures, depending on the amounts and kinds of impurities. Some bauxite is white, some red and some yellow, while still other deposits are found in combinations of these and other colors. The added impurities causing this coloring are iron oxides, silica and titanium oxide.

Bauxite deposits are widely distributed, and are to be found in many parts of the world. Commercial quantities of it have been found in Africa, Asia, Australia, Europe, North and South America. The principal bauxite producing countries are France, Hungary, Yugoslavia, British Guiana, Surinam, Italy, the United States, Russia, Netherland India and Greece. In the United States, deposits are found in Alabama, Arkansas, Georgia, Mississippi, Tennessee and Virginia. However, these latter deposits cannot be compared in size or extent with the enormous deposits found in other parts of the world. Arkansas accounts for about 90% of all the

bauxite produced in the United States, and about one-third of all the ore used in the commercial production of aluminum in the United States.

The mineral is mined by both open-pit and underground methods. Where the bauxite beds lie close to the surface, the top layers of dirt and gravel are removed, along with bushes, waste matter, and if of poor quality, the top crusts of bauxite. Temporary tracks are laid to the point in the pit where the ore is to be mined, so that the bauxite may be taken out in mine cars. The ore is then loosened in the bed by dynamiting and is loaded into the mine cars by hand or power shovels.

In other cases the beds are so deep that shafts and tunnels have to be dug in order to reach and remove the ore deposits. In such situations the mining is done just as in the case of coal or other underground minerals.

Best known and most important use of bauxite is for the production of alumina, the raw material needed to make metallic aluminum. Other uses are for artificial abrasives, aluminous cements, refractories, insulating materials and chemicals, such as aluminum hydrate, aluminum sulphate, the alums, sodium aluminate, aluminum hydrate and activated alumina. Each major use of bauxite requires a different grade of ore so that any given deposit may be adapted to the manufacture of only one or two of the several products above named. Thus bauxite used to make aluminum oxide, from which metallic aluminum is produced, must be low in silica, while that used in making aluminum sulphate must be low in iron.

When the bauxite comes from the mines it is a mixture of lumps and fines, all of which is crushed, washed, and screened to remove clay, sand and other impurities. The clay removal is one of the more important steps, since more than a pound of soda ash is consumed for every pound of silica in the bauxite. At the same time this pound of silica carries away with it a pound of precious alumina, thus reducing the recovery from the bauxite. Obviously then, as the silica content in the bauxite increases, the cost of recovery becomes greater.

The crushed and washed ore is next dried in large rotating kilns and shipped by train or boat to a purification plant where it is ground into powder. This powder, still containing many impurities, is mixed into a hot caustic soda solution. The caustic soda dissolves the aluminum out of the bauxite into itself and forms a sodium aluminate solution. The impurities are unaffected by the caustic soda, remain in solid form, and are then removed from the solution in large filter presses and wasted. The hot caustic solution containing dissolved aluminum is next pumped into great tanks, called precipitating tanks, that are as high as five or six-story buildings. As it slowly cools in these tanks, pure aluminum hydroxide, which is simply aluminum oxide chemically combined with water, settles out in form of fine crystals. This material is washed to remove the caustic soda, and then is heated white hot in large rotating kilns. This process drives off the chemically combined water of the aluminum hydroxide, and leaves aluminum oxide, or alumina, from which metallic aluminum is obtained.

The next, and final step in aluminum production, is the one discovered by Charles Martin Hall in 1886. It is the manufacture of metallic aluminum by the use of electricity, and more than any other single factor, has been the springboard for aluminum's tremendous growth in popularity and use during the past 50 years. In order to complete the change from the powder, alumina, to the metal, aluminum, vast amounts of electricity are needed. Thus the metal producing plants are always situated as near as possible to places where electric power can be had in great quantities and at low prices. In order

to keep at a minimum the loss involved in transmitting power, the Hall-Héroult process, named for the two men who discovered it at about the same time, functions at reduction works which are located within a few miles of the hydro-electric plants.

The furnaces, or electrolytic cells, in which aluminum is produced, are rectangular in shape and consist of steel shells lined with carbon. Electrodes of pure carbon project downward into the pot to form the anodes, while the carbon lining of the cells serves as the cathode. In each reduction works there are long rows of electrolytic cells, each of which is capable of turning out about 250 pounds of aluminum a day.

The successful operation of the process is based on the fact that when alumina is dissolved in molten cryolite it can be decomposed by a passage of electric current without change in the solvent. Cryolite is found commercially only in Greenland, but it has been found possible to produce a synthetic material which is the equivalent of the genuine material. In aluminum production either of these products may be used successfully.

In the electrolytic process, the cryolite bath material is first introduced into the cell. The electric current fuses it, alumina is added, and an electric current of from 8,000 to 30,000 amperes is passed through the solution. The current separates the alumina into aluminum and oxygen. The oxygen which is freed in the reaction combines with the carbon of the anodes, and escapes through the crust of the bath in the form of carbon dioxide, while the molten aluminum is deposited at the bottom of the cell. From here it is tapped into mixing ladles and cast into pigs. The cryolite bath remains unaffected through this decomposition, thus permitting a continuous process with new alumina being added to replace the amount previously made into aluminum.

The pig metal is remelted, in order to remove any impurities that may remain, and then is cast into ingot forms, varying in size and shape depending upon the uses for which they are intended. It is in this ingot form that most aluminum is sold. From the reduction plants it is shipped to fabricating mills to be rolled, extruded, forged and cast into the common commercial forms. All of these metal-working processes result in the production of basic aluminum commodities such as sheet, plate and foil; bar, rod, and wire; structural shapes, both extruded and rolled; tubing and molding; screw-machine products; rivets and nails; sand, die and permanent-die castings; and powder for paint pigment.

The present-day fields of application for aluminum are, when compared with peacetime standards, very few. All of the aluminum being produced today goes toward the manufacture of military goods. The huge airplane building program is taking the major part of the metal. The rest is being used for smaller but equally important items in the war effort. Naturally, under these circumstances, production of civilian and consumer goods is at a temporary standstill. This condition will endure until the war is won, when once again large amounts of aluminum are released for use in non-defense work, and the manufacture and sale of civilian goods is again permitted.

A good picture of the wartime use of aluminum by American industry is shown in the following table which lists the relative amounts of the metal being used by makers of different types of products. In all cases, all of the metal goes to produce military products.

Use of Aluminum by Industry

Transportation (land, air, and water)	63%
Foundry and Metal Working	19%
Machinery and Electrical Appliance	6%
Chemical	5%
Building Construction	3%
Ferrous and Non-ferrous Metallurgy	2%

Cooking Utensil	1%
General Miscellaneous	1%
Electrical Conductor	0%
Food and Beverage	0%

In normal times, the uses of aluminum in consumer goods are legion. The greatest field for the metal is in transportation, where airplanes, trains, buses and boats use freely of aluminum. The cooking utensil industry is also a large consumer, while makers of electricity-transmission equipment have produced more than 1,000,000 miles of aluminum cable in the United States. Modern buildings are large users of aluminum as architects use more and more of a metal that is attractive, cheap and easy to keep. Aluminum furniture is very popular, as is aluminum paint and wrapping foil. After the war, consumption of aluminum in these and other veteran fields will once more be resumed. New uses for the metal, born of industrial necessities encountered during the war, will make their appearance. It seems incredible that a metal, in about 50 years, should have grown to such proportions that it is used in such extreme cases as railroad cars and wrist watches. Yet this is the story of aluminum—a story unparalleled in the history of industry, and one written through vast amounts of courage, hard work and scientific research.

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Aluminum Stearate

ALUMINUM STEARATE is a metallic soap, varying from an off-white to yellow in color. The commercial material is an amorphous powder. It is insoluble in water but soluble in petroleum naphtha, turpentine, and similar paint thinners and diluents. Industrially, it is manufactured by heating together sodium stearate and a soluble aluminum salt, such as aluminum acetate. The aluminum stearate precipitates out, is filtered off, and dried.

The technical grades of aluminum stearate found in commerce are packed in 25-pound and 50-pound cartons and 100-pound wooden barrels. In 1939, 1,806 tons of aluminum stearate were produced by ten plants in the United States. In 1937, eleven plants manufactured 2,258 tons of the material. The value of the quantities shown were $601,701 and $856,771 respectively.

Several types of aluminum stearate are offered, depending upon the number of aluminum atoms attached to stearate radical in the manufacturing process. The mono-type, having one aluminum atom is employed in the molding of plastics and similar operations as a lubricant. The di-type of aluminum stearate, having two aluminum atoms attached to the stearate radical, is used as a thickening agent in the production of lubricating oils, greases, inks, and certain protective coatings, since it possesses the greatest amount of "gelling" properties of the various aluminum stearates. The tritype of aluminum stearates has the lowest gelling properties. The last named variety and mixtures of the three types are employed as flatting agents in paints and varnishes, as waterproofing agents in textiles and cements, and increasing the wash resistance of paint films. Medium gelling mixtures of aluminum stearate are also used for their suspending properties in pigmented products, in the manufacture of plastics, and in wire drawing.

On June 1, 1942 the price of the most common, medium gelling grade of aluminum stearate was 22¢ per pound. On January 1, 1942 the price was 23¢ per pound; and on January 1, 1941, it was 18¢ per pound.

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Alunite

See Alum

Amber

TRUE amber is a fossil resin, of alluvian deposit, obtained along the shores of European Baltic-sea countries. Called "Elektron" by the early Greeks—today electricity—it possesses electrical properties as outstanding as its reputation for naming this great science. It is hard, brittle and tasteless and not readily soluble. Usually semi-transparent, it will take a high polish and is yellow to brownish in color. It becomes electrically charged with the application of friction.

It is used mostly for jewelry and for making special insulating varnishes and lacquers. Reclaimed amber made from scrap pieces, under tremendous pressure and heat, is called amberloid. An oil distilled from scrap amber is used in varnish, and is also an important source of succinic acid.

The war naturally has halted imports of amber and brought a nominal price condition. However, it is officially rated by U. S. Customs as a semi-precious stone—only a small portion of the available supply being unfit for decorative use. Like precious stones, prices for amber in peacetimes varied greatly with the coloring, quality and other characteristics. Prices then ranged from about $20.00 per pound to as high as $1,000 and over. In the middle of 1942, bulk amber was not offered on the market, the supply being in the hands of manufacturers who were utilizing their stocks for finished products.

Industrially, amber is being used for electrostatic instruments; insulating ionization chambers, in radio practice, Standard Air Condensers, X-Ray practice, photography, and general electrical use where the very best insulation is required.

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Ambergris

THIS fabulous commodity is thought to originate in the intestines of the sperm whale. It is a resinous, inflammable substance, grey or black in color, and has a characteristic musty, sea odor. Sometimes it is found in a whale's abdomen and, often, floating on the sea, in lumps varying from a few ounces to as high as one hundred or more pounds. It melts at 62° C. and becomes a white vapour at 100° C. It is soluble in ether and in volatile and fixed oils. Its use is almost entirely confined to the fixation of perfumes. In minute quantities, dissolved in alcohol, it imparts its fragrance. The high price which it commands—from $10.00 per ounce upwards—has led to adulteration but it can be tested for solubility in hot alcohol, or by penetration while in a solid condition. Principal types are "Black" and "Grey." The United States has a 20 per cent duty. So far as is known, it is not of importance as a war material but the submarine activity off the Atlantic Coast has reduced the whale catch, and definitely cut into the normal supply. However, because ambergris is an abnormal growth in a diseased whale, and is so often found floating on the surface of the sea, the volume uncovered annually is greatly a matter of luck.

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Amianthus

See Asbestos

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Ammonia

AMMONIA itself is really a gas, conforming to the formula NH_3, offered commercially in compressed form as anhydrous ammonia. However, solutions of the gas in water are sometimes referred to as "ammonia," and at times ammonium sulphate, which is the most important salt of the gas, is also identified by the term.

Anhydrous ammonia, is also known as liquid ammonia, and which has been liquified by compression. Its extremely pungent odor is well known. Production of the material in

1939 amounted to 227,219,049 pounds, valued at $8,470,900. In 1937, the output totaled 216,141,910 pounds, valued at $7,787,-636. The principal source of liquid ammonia is synthetic manufacture, either by the Haber or Claude processes. The Haber process employs a reacting pressure of 200 atmospheres; and the Claude process, 1,000 atmospheres. Both operate at approximately 600° C., and effect the combination of nitrogen and hydrogen directly. The chief use of liquid ammonia is as a refrigerant. A certain amount is also used in organic chemical synthesis. Commercially, it is packed in steel cylinders containing 50, 100, and 150 pounds; and in 50,000 pound tankcars.

Aqua ammonia is a solution of ammonia in water, offered generally in a concentration of 26° Baume, which contains approximately 29.4 percent of ammonia gas. It is employed widely in industry as an alkalinizing agent, and is packed in tankcars containing 8,000 gallons, drums containing 55 and 110 gallons; carboys containing 5 and 10 gallons; and bottles containing from one to 4 gallons. Household ammonia is a dilute solution of ammonia, usually containing a small amount of soap to increase its detergent properties.

The price of anhydrous ammonia on June 1, 1942 was 5¢ per pound for a refrigeration grade, a price that has been in effect for some years. Aqua ammonia during the same period has been quoted at 4¢ per pound, based on the ammonia gas content, in tankcar quantities at the manufacturing plant.

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Ammonium Alum

See Alums

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Ammonium Bichromate

See Bichromates

Ammonium Carbonate

COMMERCIAL AMMONIUM CARBONATE (ammonia crystals) is a complex comprised primarily of a double salt of ammonium bicarbonate and carbamate and other ammonium combinations. When exposed to air it gradually loses water and ammonia and is converted to ammonium bicarbonate. The salt becomes moist and melts at about 85°C. and when dissolved in water has a marked cooling effect. In appearance it is a white powder, or hard white coated lumps with a strong ammonia odor. Being unstable and volatile, losses occur in handling and packing and allowances are made by processors in their specifications. Its uses are many: wool scouring, silk washing, dyeing mordant, baking powders, hair preparations, pharmaceuticals, ceramics, manufacture of ammonium salts, casein glues and adhesives, perfumes, tanning agent, fire extinguishing compounds, degreasing, glass frosting, and in cleansers. It is usually packed in plywood drums with a shipping weight of from 354 to 479 pounds (net weights 325 to 450 pounds) or in plywood drums with a shipping weight from 122 to 147 pounds (net 110 to 135 pounds). It is available also in 10-pound fibrepak drums packed six to the carton. Lumps, cubes, chips and powder—are the types offered.

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Ammonium Sulphate

CHEMICALLY pure ammonium sulphate is a white, crystalline material. The usual commercial grades, however, are brownish or greyish to white, depending upon the purity, and likely to be lumpy in appearance. The dirty appearance is caused by traces of tar.

The principal source of commercial ammonium sulphate is the ammoniacal vapors produced in the destructive distillation of

coal, either in the production of coke or the manufacture of gas by public utility companies. The vapors are run into sulphuric acid, followed by crystallization and drying. The ammonia derived by fixation from atmospheric nitrogen may also be used to produce ammonium sulphate by reaction with sulphuric acid.

In 1940, coke oven plants in the United States sold 1,453,009,364 pounds of ammonium sulphate, valued at $17,876,168. In 1939, sales totaled 1,153,901,833 pounds, valued at $13,153,642. Considerable quantities of ammonium sulphate are shipped in bulk in carloads. It is also shipped in bags containing 200 pounds, boxes containing 25 pounds, kegs containing 100 pounds, and barrels containing 300 or 400 pounds.

Chief use of ammonium sulphate is as a fertilizer and in fertilizer compositions. Industrial uses include soldering fluxes, in galvanizing iron, in charging electric batteries, and in fireproofing compositions. The price of ammonium sulphates in recent years has been $30 per ton for bulk shipments from spot. Material for future delivery is priced slightly lower.

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Amosite

See Asbestos

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Amphibole

See Asbestos

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Anethol

See Turpentine and Rosin

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Anglesite

See Lead

Anise Oil

ANISE or aniseseed oil, is the volatile oil distilled with steam from the dried ripe fruit of Pimpinella Anisum or Illicium verum. The latter variety is popularly known as the Chinese Star Anise, revealing the principal commercial source of the material. The former variety is indigenous to Egypt and certain other Eastern Mediterranean areas. The plant is also cultivated in Southern Russia, Spain, Italy, France, Germany, Bulgaria, Turkey, Syria, Tunis, India and Chile. The best anise seed is grown in Russia, Italy and Spain. Numerous areas in the United States are said to be suitable for growing anise, and its cultivation is being encouraged.

During 1940, 324,930 pounds of anise oil, valued at $195,858, were imported into the United States. Of this amount, China supplied 306,076 pounds; French Indochina, 10,925 pounds; Japan, 6,300 pounds; and Russia, 1,499 pounds. It is marketed in tins containing fifty pounds, and drums containing approximately 420 pounds. As standardized in the United States Pharmacopeia, anise oil is colorless or pale yellow, strongly refractive, lead-free, and soluble with not more than slight cloudiness in three volumes of alcohol.

The use of anise oil is as a flavoring agent in food, confectionary, medicinal products, and liqueurs. It is also employed in certain perfume combinations. At the beginning of June, 1942, the price of U.S.P. anise oil was $3.50 per pound. During 1941 the price ranged from approximately 75¢ to $2.00.

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Anthracite

See Coal

★ ★ ★

Antifebrin

See Acetanilide

Antimony

A SILVER-WHITE, hard, crystalline metal (Sb), antimony is seldom used in pure form but rather is marketed as antimony oxide, liquidated antimony sulphide (needle antimony), and "regulus" (metal at least 99% pure). In addition there are large quantities of secondary or recovered antimony regularly returned for further use. It is brittle and easily reduced to powder, hence not malleable nor ductile. The specific gravity is 6.62 and the melting point 1167° F. It burns with a bluish light when heated. The principal source of antimony is the mineral stibnite (antimony sulphide), but antimony bearing minerals are often found and exploited in connection with the smelting and treating of lead, copper, silver, gold and other metals.

World production of antimony, chiefly in China and Latin America, averaged about 30,000 short tons annually from 1929 to 1939. While 1940 figures are not available, it is estimated that production showed a slight increase. Bolivia is believed to have produced (exported) about 30 percent, China 15 percent, and Mexico 31 percent of the world total, while the United States production was negligible.

In 1940, the United States produced 1,124 tons of ore and concentrates, containing 494 tons of antimony, compared with the 1939 total of 3,174 tons of ore and concentrates containing but 393 tons of the metal. Antimonial lead, containing 2,077 tons of the metal, was produced in 1940 while secondary antimony recovered totalled 11,421 tons. Of 17,955 tons available for United States consumption in 1940, not counting stocks of 3,417 tons, 15,713 tons were imported in ore, 113 tons were needle or liquidated antimony, and 209 tons were metal. The average price of Chinese antimony at New York was 16.50¢ per pound against 14.00¢ for the American product.

The use of antimonial lead, for storage batteries in 1940 totaled 115,600 tons according to the American Bureau of Metal Statistics. This battery metal contains 4 to 12 percent antimony, largely from scrap, although a substantial quantity of new metal is added to "sweeten" the alloy.

An important use of antimony is as a white-base antifriction bearing metal. It also is being used at an expanding rate in making chemicals. Production of oxides—a compound used in paints and enamelware—increased to 10,211 tons in 1940, compared with 8,223 tons in 1939. Experiments with the substitution of zircon for antimony in certain enamels are being made; plated steel and plastics have been suggested to replace antimonial lead die castings; and substitutions of calcium for antimony in certain products has been proposed.

Antimony metal is used in the manufacture of Pewter and Britannia Metals although these alloys have been curtailed due to restrictions on the use of tin. Antimony trisulphate (Needle Antimony) is also used extensively by the match industry and in the manufacture of pyrotechnics.

In addition to the use of antimony in babbitt metal and in type metal, military uses include shrapnel balls, bullet cores for rifle and artillery ammunition, and priming mixtures for detonating caps.

The War Production Board, by Order M-112, effective March 30, 1942, recognized the growing demand for the armament program and the difficulty in obtaining usual supplies from China. All persons were prohibited from delivering or accepting delivery of ores and concentrates, the metal, liquidated antimony, all chemical compounds containing antimony, and any alloy containing 50 percent or more by weight of antimony—except as specifically authorized by the Director of Industry Operations. The use of the metal was restricted, and reports on stocks, were required under the order.

Aplite

See Feldspar

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Applejack

See Distilled Spirits

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Arsenic

ARSENIC is a gray to black metallic solid, usually crystalline, sometimes amorphous in appearance. Native deposits are occasionally found, but by far the largest supply is obtained from minerals and ores refined for other more plentiful metals. Its potential supply from the latter sources far exceeds demands. It is most often obtained as white arsenic, which is the anhydride of arsenious acid. The metal itself is used only to a limited extent as a flux, alloy, and hardener in lead, copper, brass, white bearing and other metals.

White arsenic is the most important commercial compound of arsenic and occurs as a fine white powder. It sometimes is found naturally and also recovered from the arsenical pyrites, or sulphides of metallic ore residues by sublimation. The domestic and world output of white arsenic in 1940 exceeded all records. Domestic production of the material in 1940 amounted to 18,241 short tons of crude material and 6,742 short tons of refined product. In 1939, production of the crude totaled 17,499 short tons, and the refined 4,842 short tons. Imports of white arsenic in 1940 amounted to 6,651 short tons; and in 1939 to 14,674 short tons. Japan and the Scandinavian countries are normally the chief foreign suppliers.

The principal field in which white arsenic is consumed is in insecticides. It is estimated that 68 percent of the material in 1940 was so used. The other consuming fields are weed killers, which took an estimated 19 percent; glass manufacture, 3 percent; wood preservative, 2 percent; and miscellaneous, including the arsenical drugs, 1 percent. Exports accounted for 7 percent. The industrial grade of white arsenic is usually 99 percent pure, with off grades, ranging from 96 to 99 percent pure also sometimes encountered. It is packed in casks containing 500 or 550 pounds; kegs containing 50, 100 and 220 pounds; cases varying from 100 to 220 pounds in weight, and boxes containing 25 pounds. The price of white arsenic on June 1, 1942 was 4¢ per pound; which price was also in effect at the start of the year. At the beginning of 1941 the material was quoted at 3½¢ per pound.

Lead arsenate and calcium arsenate are the principal arsenical insecticides; with sodium arsenite, paris green, and london purple being used in smaller amounts. The production of lead arsenate in 1939 totaled 59,568,596 pounds; and in 1937 63,291,440 pounds. Calcium arsenate production in 1939 was 39,281,788 pounds; and in 1937 totaled 37,001,959 pounds. Paris green production in 1939 amounted to 2,040,307 pounds, and in 1937 was 1,834,340 pounds. Commercially, lead arsenate in paste form is packed in 300 and 600 pound barrels; kegs containing from 12½ to 100 pounds; and in cases made up of one and 5 pound tins. In the powdered form it is packed in 100 pound barrels; and case scontaining 24 or 48 pounds and made up of bags weighing from ½ to 3 pounds. Calcium arsenate is packed in similar containers.

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Asbestos

WHERE an incombustible or a chemical resistant fiber is required, asbestos most often meets the need. Commercially, the word asbestos embraces a group of fibrous minerals of similar chemical composition, the most important variety being Chrysotile ($H_4Mg_3Si_2O_9$). The mineral occurs in fibrous masses

or seams, usually of a white, gray, or green-gray color. When processed the fibrous mass separates into silky fibers. Serpentine, when fibrous, is known as chrysotile while Amianthus is a term which is used to designate certain fine, silky varieties.

Sales of domestic asbestos reached an all-time high of 20,060 tons in 1940, a 30 percent increase over 1939 which was itself a record year, yet domestic production met only 8 percent of United States requirements, and was mostly of the shorter grades. During recent years there has been a marked increase in imports from Africa, interchangeable with Canadian grades and competing on a price basis. Amosite and blue asbestos, found in quantity only in Africa, and certain grades of Rhodesian chrysotile are utilized in special products where other fibers will not do. Imports from Africa reached a record high of 17,000 tons in 1940. Canada, however, remains our main source of asbestos. Imports from our northern neighbor in 1940 totalled 226,000 short tons—mined in the famous asbestos deposits of Quebec.

Domestic production, during recent years, has centered chiefly in the extensive deposits of slip fiber near Hyde Park, Vermont. A similar occurrence has been noted in Maine but no development work has yet been undertaken. Excellent fiber is found in Arizona, too, and a moderate increase in activity has taken place in that state.

Because of its resistance to chemicals and high temperatures, amphibole asbestos is well-adapted for certain special products such as acid filters and coatings for welding rods. Domestic amphibole production was 1,693 tons in 1940 against 450 (1939) There has been a growing demand for information on new sources of supply of high-grade anthophyllite and tremolite. Small quantities of amphibole have been mined in California, Georgia, North Carolina, and Pennsylvania; Maryland produces a high-grade tremolite.

The consumption of asbestos has depended chiefly on the manufacture of automobiles, on building construction, and on certain types of industrial activity. All kinds of automotive transport equipment require large quantities for brake bands and clutch facings. Building construction employs many products in which asbestos is an important constituent, such as asbestos-cement shingles and siding, wall-board, and various heat insulating and fireproofing materials. Steam engines and similar equipment require asbestos products for packings and gaskets, and heat insulation in the form of boiler lagging and pipe covering. Fireproof cloth, for various purposes, is another use.

Prices for the product are quoted on a short ton basis; Canadian prices are f.o.b. Quebec mines, tax and bags included; Rhodesian, South African and Russian prices, c.i.f. New York; and Vermont prices, f.o.b. mines Vermont. Prices vary greatly with the grade. Canadian Crude No. 1 is priced at $700 to $750 per ton; while Crude No. 2 and sundry crudes range from $150 to $350. Spinning fibres, magnesia and compressed sheet fibres, range from $110 to $200; shingle stock $57-$78; paper stock $40-$45; cement stock $21-$25; floats $19-$21; and shorts $12-$16.50. Vermont types and prices start with shingle stock at $57, followed by paper stock $40; cement stock $25; and short and floats $13-$18.

There have been reports of blue asbestos deposits in Bolivia and chrysotile deposits close to Madras, British India. Cyprus and Russia are producers but production data are scanty and imports here negligible. Germany, according to reports, has developed brake lining consisting of aluminum and steel wool, incorporated with synthetic rubber as a binding.

The War Production Board, effective February 28, 1942, by Order No. M-79, prohibited any person from fabricating, spinning or processing in any way asbestos fiber imported from South Africa except where

such fabrication, etc., is necessary to fill Defense Orders. In addition, all persons were prohibited from using Chrysotile asbestos fiber (Rhodesian) Grade C and G-1 and 2 except for certain purposes; or Amosite fiber of certain grades, for certain uses. The Order also limited inventories and required reports from all persons who manufacture or process asbestos fiber.

On March 30, 1942, WPB, by order M-123, prohibited deliveries or use by manufacturers of asbestos textiles without authorization except for use in the manufacture of industrial packings or woven friction material or on orders bearing a preference rating of A-10 or higher.

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Ascorbic Acid

ASCORBIC ACID also has been known as cevitamic acid and hexuronic acid in the past, and is the pure vitamin C. It was the first vitamin for which the exact chemical structure was identified. Vitamin C is now commonly applied to the natural material, obtained from citrus fruit juices; while ascorbic acid is applied to the synthetic material, produced by the controlled oxidation of dextrose.

The production of ascorbic acid synthetically in the United States during 1940 amounted to 33,375 pounds, produced in three establishments. Sales of ascorbic acid in that year totaled 26,714 pounds, valued at $850,315. No figures are available as the amount of natural vitamin C produced. Commercially, ascorbic acid is packaged in 250, 100, and 50 ounce drums; and in 25, 5 and one-ounce bottles.

Ascorbic acid, like the natural vitamin is used entirely in medicine. The price of synthetic ascorbic acid on June 1, 1942 was $1.50 per ounce. On January 1, 1942, it was $1.85; and on January 1, 1941, $2.00 per ounce.

Ash

See Hardwoods

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Aspirin

See Acetyl Salycilic Acid

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Atabrine

A TRADEMARKED quinine substitute, Atabrine is a derivative of acridine, a yellow coal-tar dye. Production has been stepped up sharply by the producing company and it is estimated that enough can be made to entirely replace our quinine needs.

Atabrine, according to claims, works faster than quinine and one ton will cure 600,000 cases of malaria against 30,000 cases cured by a ton of quinine. While quinine costs less per pound, the dosage of atabrine is smaller and hence allegedly more economical.

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Babassu Nuts

THE babassu is an oval nut varying in size from 3 to 7 inches in length and about 4 to 6 inches in diameter. It is a product of the babassu tree which grows wild throughout the tropical regions of Brazil.

Each babassu nut has from 3 to 7 kernels. The kernels, when extracted from the nut, are exported. The oil from the kernel is also shipped here. The nuts are not exported to this country. They are extremely hard and difficult to open without crushing the kernel.

Babassu nuts are produced along the Tonkin River in the States of Maranhao and Para, Brazil. Production is confined to areas close to river transportation because of the lack of railroads and highway in the jungles. It has been estimated that about 13 billion

babassu palm trees could be developed and cultivated in Brazil if there is sufficient demand to absorb the output and adequate transportation facilities available.

No babassu nuts are grown in the United States and domestic supplies are imported from Brazil. During 1940, the United States imported 98.3 million pounds.

The babassu tree has many uses. The kernels yield about 65 per cent of oil. The oil from the kernel is used in the manufacture of soap, margarine and shortening. The cake and meal are fed to livestock and the sap can also be used as an animal feed. The covering of the nut provides a fiber for brushes, matting and rope. The shell can be used for the production of buttons and ornaments. The husks, when distilled, yield acids, lubricating oils, creosol, resin, dyes, carbolic acid and fuel charcoal. The leaves of the tree can be made into baskets, bags, mats and straw hats as well as roofs and walls for cabins.

The marketing unit is the ton or 1,000 Kilos. The usual lots sold are about 100 to 150 tons each. Prices are quoted on the basis of 1000 Kilos F.O.B. port of shipment in Brazil. The price at one time in the spring of 1942 was $125.00 per ton F.O.B. Transportation is in bags by steamers.

Babassu nuts will keep indefinitely. There is only one grade. Substitutes are murumuru, tucum, corozo and coquito kernels. Cocoanut and palm-kernel oil possess similar qualities to babassu oil. There is no duty on babassu kernels.

Babassu nuts, kernels and babassu nut oil were placed on list A of strategic materials in amendment No. 4 to General Imports Order M-63 issued by the War Production Board on April 8, 1942. Governmental controls were imposed over imports.

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Babassu Oil

See Babassu Nuts

Babbitt Metal

A TERM now applied generally to any combination of metals used as a bearing metal, usually a "white" alloy containing varying quantities of either lead or tin. Originally, the name came from the inventor and the initial metal was composed of copper, tin and antimony in specific proportions.

Commercially, white bearing metals vary in tin content. Some run above 50 percent tin while others have a large proportion of antimonial lead and only a small percentage of tin. The copper content seldom exceeds 3 to 4 percent. Babbitt for connecting rod bearings contains 86 percent tin, 5 to 6.5 percent antimony, and not over 0.35 lead. Prior to the war, most companies had their own trade-marked "babbitt metal," covering a wide range of combinations for a variety of uses.

The war shortages of strategic metals has brought sharp changes in babbitt metals. Experiments are constantly being made with various new and untried combinations in order to conserve the scarcer metals.

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Baddeleyite

See Zirconium

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Bagasse

AN IMPORTANT byproduct in the manufacture of raw sugar from sugar cane, bagasse is the residue left after the cane has been passed through the necessary process to remove every bit of sugar juice. In most tropical cane-producing countries, it serves as a fuel for the sugar mills, sometimes supplemented by other fuels.

In the United States, however, it is used extensively as the base for a material made into wallboard, paneling and such building materials.

The sugar cane fibers, which pass through successive rollers for the extraction of the juice, are long and tough.

"Celotex" is the trade name for the product made from bagasse. It is manufactured as plain Celotex board, or, surfaced with cement and asbestos, it is known as "Cemesto" board.

The war production program has brought an unprecedented demand for Cemesto board for war housing. Many in the building industry predict that the postwar period will see a tremendous upsurge in building on a low-price scale, using this board or similar material cut to exact size in the factory.

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Ball Clay

See China Clay

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Balsa

BALSA, the lightest commercial wood in the world, is nearly white, sometimes brownish or reddish. It varies in density between 6 and 18 pounds per cubic foot. Processing is in the same manner as ordinary lumber of other species. Practically the sole source of supply is Ecuador, although small quantities come from lower Central America and northern South America. The United States produces no balsa wood. In 1941, total world production was approximately 17 million board feet. Balsa wood is used wherever there is need for buoyancy, for a strong light-weight material or for insulation. War needs are principally for life-saving equipment, ships bilge fillers and floats of various kinds. Civilian uses run into the hundreds, including such articles as models, sporting goods, display equipment, refrigeration, musical instruments, etc. Due to rapid changes in freight costs, marine insurance, log prices, etc., the price has not been stable recently. As of May 1942, price quotations were about $185.00 per thousand board feet, the marketing unit, for first grade material and $165.00 for the second grade material. It is shipped to the United States chiefly in bundles bound with steel strapping, of uniform cross sectional area, containing boards of the same length. The lumber, if kiln dried, will last indefinitely. Principal grades are first and seconds, more a matter of appearance of the wood rather than usefulness. Models use first grade while general industrial work can get along with second grade. Cork and kapok are the main substitutes. It enters the country free of duty but an excise tax of $1.50 per thousand board feet is imposed on unmanufactured lumber. The International Balsa Corporation reported in May that the war has affected the supply only to the extent of curtailed and irregular shipping, and, has curtailed the supply available to civilian uses.

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Balsam Fir

See Spruce

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Barbituric Acid

BARBITURIC ACID and its derivatives are important medicinally for their sedative and hypnotic actions. The most popular compounds of the group are barbital or diethylbarbituric acid, and phenobarbital or phenylethylbarbituric acid. Barbital is also known as veronal and barbitone, and phenobarbital is sometimes known as luminal. In addition to its medicinal use barbital is also employed as a stabilizer for hydrogen peroxide and in certain plastics. Both of the compounds named are official in the United States Pharmacopeia.

In 1940, production of barbituric acid and derivatives in the United States totaled 353,-

157 pounds. Sales in that year amounted to 141,327, valued at $686,030. Commercially, barbital and phenobarbital are packed in drums of various weights, 25-pound cartons, and 5 and one-pound bottles.

The price of barbital on June 1, 1942 was $3.50 per pound. On January 1, 1942, and January 1, 1941, the same price was in effect for the material. Phenobarbital on June 1, 1942 was quoted at $4.00 per pound, which price was also in effect on the first of the year. On January 1, 1941, phenobarbital was priced at $3.60 per pound.

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Barite

A NATURAL barium sulphate, ($BaSO_4$), barite is mined in about a dozen states. Producers in 1940 were Arkansas, California, Colorado, Georgia, Missouri, Nevada, South Carolina, Tennessee, Texas, Virginia. In other years, Alabama, Arizona and Montana supplied part of the United States supply.

The metal Barium (Ba) of the alkaline earth group is obtained from Barite or from Witherite in which it occurs. It finds its greatest use in various compounds, for hardening lead, and as a deoxidizer in purifying alloys of copper, tin, lead and zinc.

Barite, is sometimes known as Tiff or Heavy Spar. Its hardness is 3 to 3.5, the specific gravity 4.4 to 4.8. It is found with various ores or with limestone.

New all-time records for domestic production were reached in 1940 when 390,462 short tons were mined. Imports of crude barite in that year were 7,391 tons, all from Cuba while sales or use by producers totaled 409,353 tons. Crude barite, f.o.b., Georgia mines is quoted at $7.00 per long ton. The standard grade of the crude product usually ranges from 93 to 95 percent $BaSO_4$ with less than 1 percent iron.

In 1940, 200,899 tons of barite were utilized in the manufacture of ground barite, 136,885 tons for the manufacture of lithopone, and 66,604 tons for barium chemicals. Witherite, combined with barite in United States production figures, is found in a nearly pure state in England but in America as a barite-witherite mixture. Imports come entirely from England and total but a few thousand tons per year.

Barium chemicals include barium carbonate, barium chlorate, barium dioxide, barium hydrate, barium nitrate, and barium sulfate.

Barite used largely in the production of lithopone, 77 percent of which is taken by the paint industry, is also ground and used as a filler for paints, linoleum, rubber, plastics, cloth and paper. Prime white and floated grades are used for paper. Artificial barite, Permant white and Blanc fix are trade names for white fine-grained precipitated products of U.S.P. or fine paint types. Ground barite finds a use, also, for weighting drilling muds.

The war program has increased the demand and utilization of barite, especially in the production of lithopone.

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Barium

See Barite

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Barley

THE barley plant is adapted to regions of cool summers where the soil is not too sandy but is well drained. It does not do well under humid conditions where high temperatures prevail. Under arid and semi-arid conditions it can grow even in the tropics if sufficient water is available.

Under suitable conditions of soil and cli-

mate, barley yields more in pounds of seed per acre than other small grains. It matures quickly and so can be seeded later than spring wheat or spring oats and still produce a satisfactory crop. This quick maturity allows it to be used for late seeding where few other crops could be sown to advantage; this particularly recommends it in the Dakotas.

The most important diseases of barley are covered and loose smuts, striped disease and scald. Barley smut usually occurs to some extent wherever the crop is grown, causing losses from a trace to 50%. The usual protection by the farmer is treatment of the seed when planted. Barley is subject to periodic heavy infestation by the Hession fly when grown in regions where this insect is abundant. However, the present principal producing areas lie outside of the preferred habitat of this insect and comparatively little general injury from this pest has occurred in recent years.

The leading producing nations of the world are Russia, United States, Germany, Canada, Hungary, Rumania, India, North Africa, Spain and Japan. World production ranges from 2 to 2½ billion bushels. U. S. production in 1941 amounted to 359 million bushels. The leading producing states are Nebraska, Minnesota, the Dakotas, Kansas and California.

Barley has three principal uses: animal food, barley malt, and pearled barley. As an animal food barley ranks well with corn. It contains approximately the same percentage of carbohydrates as corn, approximately 3% more protein, and approximately ¾% less fat. Animals fattened on barley produce a leaner meat than those fattened on corn. In general from 60 to 70% of the barley grown throughout the United States is fed to livestock in the state in which it is raised. The barley which is shipped to terminal markets and which is found not suitable for malting or pearling purposes finds its way back to feed channels through manufacturers of mixed feeds.

The barley used by the malting industry represents the choicest portion of the crop. Since the process of malting is highly critical only certain types of barley are desirable for this purpose, and of these types only lots which meet the specific requirements as to soundness, mellowness, size of berry, freedom from blight and other diseases are used. Because of these exact requirements, barley which is suitable for malting usually commands a substantial premium over that used for any other purpose. Pearled barley is barley from which the outer husk and part of the bran layer husk has been removed, and the product is generally used for human consumption. The requirements for pearled barley are in some respects similar to those for malting barley. The grain must be sound, sweet and cool, plump and heavy berried; must not contain too much moisture, and must not be musty, mouldy, or contain any heat-damaged kernels.

The marketing unit is the bushel, weighing approximately 48 pounds. The price in Minneapolis early in June, 1942 approximated 59¢ a bushel.

A number of different factors are considered in classifying barley, but two which are of great importance are whether or not the barley is two-rowed or six-rowed, and color. With six-rowed barley there are three kernels at each node of the spike, and since the nodes alternate the result is three rows on each side of the spike, or a total of six rows. Two-rowed barley has a single kernel at each node, and since the nodes are on alternate sides of the spike, there are two single rows. Barley may be white, black, red, purple, or blue. Under the Federal Grain Standards, there are three classes in addition to mixed barley: "barley," black barley, and western barley. The class, "barley," is divided into two sub-classes: malting barley and "barley." Within those classi-

fications there are numerous varieties of barley, but in each growing region there are certain predominant varieties grown.

Substitutes consist of other feed grains. The duty is 20¢ per bushel and 15¢ per bushel from Canada.

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Barley Malt

BARLEY MALT is barley which has been artificially germinated by moisture and kiln dried. In physical appearance it resembles barley itself. It is processed from selected barley which has been cleaned and graded for size, steeped, germinated in darkness or semi-darkness, kiln dried, and screened for shipment. The entire process is combined with exacting moisture and temperature controls. The annual prewar world production of malt was estimated as 215 million bushels, of which the United States contributed about 65 million bushels. United States production is centered in the states of Wisconsin, Minnesota, Illinois, New York, and California, with scattered production in other states. Imports, while reduced at present, ranged in the 1934-1938 period from 10 to 17% of the total U. S. consumption. In 1941, approximately 90% was used in beer production; 6% for distilled spirits; and 1% for domestic alcohol while the remaining 3% went into such uses as solvents, cereal foods, malted milk, malt syrups, yeast, baking syrups, animal foods, etc. It is marketed by the 34-pound bushel, although exports are often quoted by the English or metric ton. In April of 1941, the standard grade was quoted at $1.18 to $1.19 per bushel f.o.b. Chicago. It is usually transported by rail in bulk or in returnable cotton sacks. It is not perishable if kept dry. Principal types are Brewers Standard, Brewers Choice, Brewers Fancy, Distillers, Diastatic. Differentials between grades are fairly stable but are dependent on the quantity and quality of the crop. There are no substitutes for malt where malt is used, although it may be used in varying quantity. The import duty is 40¢ per hundredweight.

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Baryte

See Barite

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Basswood

See Hardwoods

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Bauxite

See Aluminum

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Bayberry Wax

BAYBERRY or myrtle wax is a gray-greenish unctous material, slightly more brittle than beeswax, obtained from several species of Myrica plants. The principal source of this wax is from Myrica cerifera, which is an aromatic herb native to the United States from New Jersey to Louisiana. However, domestic production of bayberry wax has been nil for a number of years and the principal current source is Colombia, South America. In securing the wax, the berries are boiled in water so that the wax melts and floats to the surface. It is then skimmed off and strained, or allowed to solidify directly on the surface as the system cools. For purification it is again melted, strained and cast into large cakes.

Chief use of bayberry wax is in the manufacture of candles or tapers. It is preferred for such use since it emits a somewhat fragrant odor on burning. Bayberry tapers are especially burned during the Christmas holidays. The wax is also sometimes substituted

for beeswax. Commercially, the material is packed in bags and cases or boxes. During the past few years bayberry wax has been priced at from 18 to 20¢ per pound in the commercial market.

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Bay Oil

BAY OIL is also known as bayleaf oil and is official in the National Formulary as oil of myrcia. It is obtained by distillation of the leaves of Pimenta acris, a small tree native to the West Indies. June and July are the best months for picking the leaves for distillation, approximately sixty pounds of which are required to produce a pound of oil. The distilled oil is made up of two fractions, a heavy and a light portion. The normal oil is obtained by mixing the two portions. Absence of the heavier portion results in an inferior oil.

The quality of bay oil commercially is based on its phenols content. The National Formulary requires a content of at least 50% and not more than 60% by volume. In addition to the standard product, bay oils containing from 60% to 65% and from 40% to 45% phenols are also available commercially. The latter is the lowest in price. It is packed in 25-pound tins.

Most important use of bay oil is in perfumes, particularly in "bay rum." It is employed in soap perfumes to impart an odor of freshness. On June 1, 1942, a 50% to 55% West Indian bay oil cost from $1.50 to $2.00 in the New York resellers market. At the close of 1941 this grade was priced at from $1.25 to $1.50 per pound. At the beginning of 1941 the price ranged between 90¢ and $1.00.

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Beech

See Hardwoods

Beef

IN ancient Rome, cattle were so important that the word for money, "pecunia," came from "pecus," meaning cattle. Vergil's verse mentions cattle breeding and even branding.

In the Bible we find the Golden Calf, and the "cattle upon a thousand hills," and see Abraham and Lot going distant ways to give their cattle wider pasture.

With the Norsemen who crossed the Atlantic nearly a thousand years ago came herds of cattle. Apparently Iceland and Greenland in those days even exported butter and possibly beef and hides to Europe. And with the Vikings who apparently settled briefly upon the coast of Massachusetts came a bull that was most valuable in battle, for when it bellowed, the red men fled.

Columbus, having found domestic meat animals almost entirely missing in the New World, brought along on his second voyage cattle, hogs, sheep, and poultry.

Ponce de Leon apparently landed cattle and other live stock in Florida in 1521, and some of the cattle at least must have survived and multiplied, as the French near St. Augustine in 1564-65 were told by the Indians of strange animals that the French decided must be "unicorns"! In the same century West Indies pirates stole so many cattle, and dried or "boucaned" the beef, that American history was given a new word —buccaneer.

In the starving time at Jamestown, and even for years afterward, food supplies were so meager that to slaughter meat animals or poultry without the High Marshall's permission was made a capital offense. In early Plymouth, to own one cow required a partnership of six people.

Much of the heavy work of the farm in past generations was done by oxen. In his book, "George Washington, Farmer," Paul L. Haworth states that Farmer Washington left to his heirs 300 cattle, as well as many

sheep and a wandering, uncounted stock of hogs. At Mount Vernon he sometimes had thirteen yoke of oxen—which, after toiling in his fields for seven or eight years, eventually were ungratefully turned into beef.

Beef gave us our national character, Uncle Sam. The original Uncle Sam was a meat packer at Troy, N. Y., whose product and employees alike went to the Army in the War of 1812. His casks of meat for government use were naturally stamped "U. S." but in Troy they jokingly insisted that those initials stood for Uncle Sam Wilson, and whenever one of his workmen followed the flag to some new horizon, he took along the best story he knew—the claim that his employer was feeding the American army, as could be proved by the initials on every keg of meat!

Today a vastly bigger Uncle Sam is feeding a larger army than the historic meat packer of Troy would have thought possible, flung afar into lands he never heard of, a ration based upon nearly a pound of meat per man per day. Practically every state in the Union has had a part in producing this meat.

On January 1, 1942, there were nearly 75,000,000 cattle on American farms. About one-tenth of these were in Texas, and almost two-thirds were west of the Mississippi river, but every state was represented; even Rhode Island boasted about 29,000. About 36,000,000 were beef cattle—of which there were at least 120,000 in every state outside of New England, with the exceptions of New Jersey, Delaware, Maryland, and South Carolina. About three-fourths of the beef cattle, however, are raised west of the Mississippi River, with Texas having more than 5,000,000, Iowa nearly 3,000,000, Kansas and Nebraska more than 2,000,000 each, and nine other states (Missouri, Oklahoma, Illinois, California, Colorado, New Mexico, Montana, South Dakota, and Minnesota) more than 1,000,000 each.

A steer grown in one state may be fattened for the market in another; hence the country's stockyards handle feeder stock as well as those intended for immediate processing. Thus thousands of cattle every year make their first trip to the stockyards a round trip!

Some of the country's leading cattle markets are, in approximately the order named, Chicago, Kansas City, Omaha, South St. Paul, East St. Louis, Sioux City, Fort Worth, Denver, Oklahoma City, St. Joseph, Indianapolis, Pittsburgh, Jersey City, and Cincinnati. There are public stockyards in more than fifty other cities, and important private yards in still others. Western packers build their plants near live stock sources, seldom shipping live stock far or buying them already dressed; while plants in the East buy either live stock or dressed meat, possibly from a considerable distance.

Some companies sell their products through branch houses distributed through many states, or direct from a company's various plants by refrigerator car routes which serve communities not reached by a branch. But there are many companies, most of them operating single plants, whose business is confined chiefly to their adjacent communities, and which make deliveries by truck or other local carrier. The larger use of refrigerated motor trucks in recent years has greatly widened the packer's quick-delivery zone.

No matter how many meat animals the farmer raises, or what type of them, and no matter when he decides to sell them, the nearest live stock market will turn them into cash for him. From there they go through the meat packing plant, then the refrigerator car or local delivery truck or both, and finally the retail store, where any modern housewife probably has a greater all-year choice of meat than had Solomon in all his glory. And with fastidious housewives everywhere needing and expecting any and every meat cut to be conveniently available

practically any day of the week, the job of collecting and processing meat and of distributing it perhaps hundreds of miles from where it grew is hardly less colossal than the farmer's own responsibility of producing it.

In the "good old days" when cows and pigs still ran loose in city streets, any consumer, in theory, could be his own meat grower. When the Comanches chased a buffalo herd, or when a boatload of Eskimos ride the waves to find the walrus, or when South Sea islanders pounce upon a whale washed onto the beach, the whole community cooperates—or fasts when nature's larder fails. There is a striking contrast between the typical American town of today, with the calm dependability of most of its food supplies, and even the romantically haphazard village of yesterday, which still exists in some remote communities, fasting and feasting in turn according to how promptly its provisions arrive. Some summer vacation visitors at a store in the mountain wonderlands of Wyoming, for example, a hundred miles from the railroad, were told no meat was available. The next day, however, a "Fresh Meat Tonight" sign was beaming down on half the town's population. When at last the life-saving meat truck arrived, everybody paid the same price per pound. If early, you got loin or sirloin; if late, round steak; if last, a soup bone!

A few years ago the Government released some figures on the average hauls of meat and live stock on American railroads. Cattle and calves in general rode an average of 409 miles to market; double-deck cars of calves averaged 145 miles farther. Sheep got the longest rides, averaging 453 miles in single-deck cars and 639 in double-deckers. Hog shipments divided between upper and lower berths traveled 541 miles; those in lowers only, 244. After being turned into meat, all classes greatly increased their mileage—fresh meats traveling an average of 918 miles per trip, and cured or dried meats 1,011 miles.

Annual beef production in the United States is usually around 7,000,000,000 pounds, and veal production about 1,000,000,000. Until 1941 the record year for beef was 1918, in which about 7,726,000,000 pounds were produced and about 700,000,000 were exported—perhaps half of the exports going to the American army in France. In 1941 both beef production and consumption probably passed 8,000,000,000 pounds for the first time in the country's history, and beef consumption per capita possibly exceeded 63 pounds for the first time since 1919 (in 1918 it had passed 69 pounds). Total meat consumption per capita was probably about 145 pounds—the largest since 1924, although that figure formerly had been exceeded thirteen times in fourteen years (1899-1912) and although the average for all years since 1900 is about 141 pounds.

Before the present war the world's cattle population was probably around 700,000,000, of which perhaps 300,000,000 were in Asia and about 100,000,000 each in North America, in South America, and in Europe outside of Russia. Yet the United States produced and ate perhaps a fourth of the world's beef. By contrast, in India, where the Hindus hold some cattle sacred, beef production and consumption are comparatively low, although British India alone boasts more than twice as many cattle (including water buffalo) as does the United States. Other leading cattle-producing countries were Russia, with more than 60,000,000; Brazil, with about 40,000,000; Argentina, with more than 30,000,000; China and Germany, with about 20,000,000 each; France, with about 16,000,000; and Australia, with about 13,000,000.

Meat and live stock prices are of course determined primarily by the quantities of various types of live stock marketed and by the purchasing power of consumers. Those

in turn are significantly influenced by other variables. For example, the size of the beef crop annually is in part a result of the cattle price levels of several years earlier, since those prices were factors considered by millions of farmers in deciding how many cattle to keep in their breeding herds. Similarly, the size and quality of the beef crop are influenced also by many other factors, such as the comparative scarcity or abundance of grains, grass, and other feeds, the presence or absence of loss due to droughts, floods, or blizzards, and interest rates charged by banks in the cattle country, and so on. On the other hand, the demand factor also is affected by a great number of variables, such as whether jobs are scarce or plentiful, whether wages are comparatively high or low, whether housewives prefer economy cuts and more careful cooking or the most popular cuts and more leisure from the kitchen, and so on.

The entry of the United States into an "all-out" war has affected both the supply of meat and the demand for it. It has strengthened demand not only by greatly increasing employment and total wages, but incidentally by feeding the men in the country's armed services a bigger and better-balanced ration than most of them probably were getting at home, and also by utilizing the Red Cross and other agencies to give thousands of housewives an improved knowledge of basic principles of nutrition and diet. On the other hand, it has probably also increased the supply of meat for some years to come by encouraging farmers to produce more, not only for the sake of patriotism but also with an assurance of the continuance of a profitable market.

Beef is ordinarily delivered to the retailer in cloth or paper bags. Individual products such as canned meats, chipped beef, sausage, etc., may have special containers of tin, glass, oiled paper, etc. Army rations are often delivered in boxes or otherwise according to minute specifications worked out to minimize field transportation and service problems. Incidentally, due to the Japanese victories in the Far East, some of the dog food manufacturers unable to get tin cans have learned to dehydrate their product for sale in other types of container.

Beef prices are inclined to reflect demand far more than relative quality or exact nutritional value. A comparatively few experts, grouped mainly in the meat industry, governmental meat inspection services, and the agricultural colleges, are able to distinguish one grade of beef from another, but usually they do so only after years of training, and usually with an entire side or quarter to study. The housewife cannot be expected to find such opportunities; hence she can most easily obtain quality in the meats she buys by choosing a retailer whom she finds she can trust, and then by relying upon him and upon the manufacturer from whom he buys.

Neither grade nor price, however, have much relation to nutritional value. Two pieces of equally lean or equally fat beef are likely to be practically equal in nutritional value, and probably are potentially equally delicious, regardless of whether one may have come from a more popular cut costing half again as much per pound as the other. Thus price distinctions in meat are more likely to represent differences in cooking convenience, or in other factors of personal choice, than in their food values.

Meat packing differs from most manufacturing industries in the fact that it is taking something apart, rather than assembling something, and in the fact that its product is highly perishable. Most manufacturers buy a number of raw materials and combine them into one or more products; the meat packer does just the opposite, turning a single steer, for example, into a number of products. Incidentally, he gets from each 100 pounds of steer only about 55 pounds of meat(plus of course some by-products),

and that of course helps to explain why the price of the average pound of meat must be considerably more than the price of a steer per pound. This fact is too often forgotten, however, by people making such comparisons; and they are likely also to pick a popular cut of meat, rather than one of average price which would better represent the animal as a whole.

Many war industry manufacturers and others who today use the conveyor system to haul the material past the workman would be surprised to learn that their assembly line really started as a disassembly route in the meat packing industry and has been in use there for two-thirds of a century already.

The perishability of meat and of live stock is an extremely important factor in the meat packing and related industries, and one particularly important in the case of beef, since most beef is sold fresh. Except for his refrigerator's capacity, the man who sells fresh meat and even to some extent the one who sells cured meats are like a man that peddles Christmas trees—he must sell them quickly or not at all. And as for his refrigerators, if he did not keep their contents moving there would soon be no space in his coolers for the newest product arriving, while the costs of continued refrigeration of the older product would soon turn his hoped-for profit into a growing deficit.

The perishability of meat has also been important historically, both in the industry and beyond it. Only within the last two or three generations have refrigerators whirred across the country on railway and truck wheels to supply fresh meat to every corner market. Before that date meat packing was largely a winter industry devoted mainly to pork packing, and so it remained until shortly before the Civil War, when a period of natural ice refrigeration of meat packing plants began, during which the ice house often dwarfed the rest of the plant. Shortly after that war came the "ice boxes on wheels" which were our first refrigerator cars.

During the first half of the nineteenth century, beef eaters on the Atlantic coast and even some consumers of razorback pork in the same regions had had their meat delivered practically on the hoof. While waiting for railroads to be invented, debated, tried out, financed, built, and pushed patiently across the mountains, farmers of the Ohio valley had to walk their herds of mountain-climbing cattle and even of hogs for hundreds of weary miles from farm to seaboard market. In Baltimore such cattle sold for $25 each, plus or minus $1 for each inch of waistline circumference over or under a certain average—a valuation basis which contrasts strikingly with the modern buyer's careful appraisal of each animal's potentialities.

In the same period, a seemingly invincible dictator named Napoleon had offered and paid a small fortune for a new way of preserving food for his armies (canning).

Still earlier, of course, dried or "jerked" meats and "packed" or "pickled" meats, to some extent, had bridged the gap from one winter's meat crop to the next, or from port to port as sailors fought the tempests or cursed the calms; and the lure of spices which would flavor foods, if not actually aid in their preservation, had raised to eminence a city named Venice, and had beckoned to discovery a traveler named Marco Polo and a sea-captain called Columbus.

★ ★ ★

Beer

BREWING is a highly exacting process, requiring constant scientific quality control and strict observance of the highest standards of purity and cleanliness.

The exercise of quality control begins, naturally, with the selection of the brewing materials. For its raw materials brewing

demands premium agricultural products. American brewers pay approximately $100,000,000 a year for choice barley, corn, rice and hops.

Malt

Malt, made by moistening barley so that it sprouts or germinates, is the basic brewing ingredient. Hops are added for its preservative qualities and to impart to the beer its characteristic aroma and flavor. Most beer also contains a malt adjunct in the form of rice or corn products, which are used as blends to achieve refinements of taste, flavor and appearance favored by the American public. Barley of the finest quality is employed in the production of malt.

Caramel malt used in the brewing of Bock Beer is "toasted" and is caramelized after leaving the kilns by subjecting it to a higher temperature in specially designed equipment. Extreme care is exercised in the caramelization process in order that this type of malt may contain the correct shade of color and flavor so characteristic of Bock Beer.

Black or roasted malt used in the brewing of Porter or Stout is treated in much the same way as caramel malt except that a higher degree of heat is employed and the roasting process is carried on for a longer time until the malt has acquired the pleasant roasted taste which characterizes a well brewed Porter or Stout.

Upon arrival at the brewery, the malt is subjected to laboratory analysis to determine its qualities and characteristics, and is then stored in clean, dry bins to await the brewing.

Hops

Hops are the blossoms of the hop vines and are grown in this country principally in the states of Oregon, Washington, New York and California. Quality control plays an important role in the growing, picking, and drying of choice hops. While growing, the hop vines are constantly cared for to prevent mold infection or other flavor-destroying elements. The hop blossoms must be carefully picked at exactly the right time to prevent their being either over- or under-ripe. They must be picked clean and free from leaves and stems. They are then dried by one of the approved methods and this drying process is carefully controlled to conserve the delicate, fine aroma essential in a choice brewing hop. The dried hops are then compressed into bales weighing about 200 pounds each and are shipped to breweries, where they are stored in clean, cold storage chambers, the temperature and humidity of which are maintained constant to assure perfect keeping. Before hops are purchased by the brewer, numerous samples are submitted for selection of the proper type required for the production of a quality brew.

Analysis of hops includes a physical examination to determine the quantity of leaves, stems, or other undesirable substances which might be present due to improper picking. Also noted are aromatic characteristics, general appearance, and lupulin content. It is also important to determine the comparative degree of bitterness of various samples. The alpha, beta, and gamma resin content is determined by dissolving them in their respective solvents. The ratio of these resins present indicates, in part, the brewing value of hops.

The Brewing Process

(The actual brewing process is covered completely in Commodity Year Book—1940.)

Racking and Bottling

Following the proper aging period, the brew is transferred from storage to finishing tanks from which it is either racked into barrels or bottled. During this transfer, from storage to finishing tanks, the brew

is carbonated by reuniting with it the delicately flavored carbon dioxide gas produced during and collected from fermentation. It is subsequently cooled and filtered through specially designed filters which assure absolute brilliance. Great care is taken to make sure that the brew is properly carbonated so that it will not be either too lively or too flat and this carbonation is controlled by use of an instrument which indicates to the operator the exact CO_2 content of the brew.

In the racking process, the brew is transferred through a very accurate Government meter to the racking machine which is so designed that it fills the barrels under pressure to guard against the loss of any CO_2 gas during the filling.

The barrels into which the brew is racked are automatically soaked, scrubbed, and washed after which they are carefully inspected by lighting the inside of each barrel with an electric light designed for this purpose. Having passed inspection, the barrels are next tested to make sure that they are absolutely tight. This test is made by filling each barrel with air under pressure and immersing it in water. Any leak, no matter how small, would cause air bubbles to rise to the surface of the water and these would be detected by the test operator who would then remove the leaky barrel from the machine and send it to the repair department.

In the bottling process, the brew is transferred from the brewery to the bottling department through a standardized Government meter which is, at all times, under strict supervision of the U. S. Government Inspectors. After passing through the Government meter, the brew enters the automatic bottle or can filling machine. The bottles or cans are filled under pressure to assure the proper CO_2 content, which imparts that pleasing sparkle and rich, creamy foam so essential in good brews. These filling machines are so designed that they automatically will not fill an imperfect bottle or can.

Containers

The containers into which the brew is filled are thoroughly soaked in a sterilizing solution under controlled temperatures. They are then thoroughly washed several times with clear, fresh water and are finally carefully inspected under daylight lamps. Immediately after being filled, the containers are sealed or capped to prevent any loss of CO_2 gas. They are then transferred into and through the pasteurizer. This pasteurization of the beer is accomplished at accurately controlled and recorded temperatures to insure keeping quality. Leaving the pasteurizer, the containers are transferred into the labelling machine, in which the body and neck labels are neatly and securely affixed. They then pass on into the packing machine, each container being guided into the case to prevent any disfiguring of the labels. During the entire bottling process, the containers are automatically conveyed from one machine to another.

The Brewers Foundation

Brewing Industry Foundation is the Public Relations Representative of the Brewing Industry in the United States, and has developed an extraordinary group of public service activities in the past five years which have won nationwide attention for its public messages and campaigns, honorable mention in the Annual Advertising Awards, and united industry endorsement and cooperation.

The Foundation is a non-profit incorporated membership association which was established in 1936 and which commenced its public work in the spring of 1937 with a meeting attended by hundreds of public and group leaders to whom the service program was outlined.

Very simply, the functions described at that time and followed in the intervening years are:—

1. To interpret the public interest to

the brewers so that they may govern their attitudes and actions accordingly.

2. To interpret the industry to the public so that the public may judge of the industry on the basis of facts.

Leading brewers had watched the trend of their business in the years following beer's relegalization in April, 1933 (8 months before Repeal of Prohibition) and they decided that they must set up an organization to cooperate with the public authorities and the public generally in avoiding conditions which had developed through abuse by a minority of retailers of the license to sell beer. Usually, beer itself had nothing to do with the conditions leading to public offense and condemnation . . . but beer too often got the blame for such conditions. The brewers decided to tell the public they didn't want such conditions to exist or develop, that they would stand behind the vast majority of respectable retailers and would cooperate with the public authorities on effective regulation to "clean up or close up" law violating retailers who used the beer license as a mask for offensive and law violating activities.

The Foundation also found that many misstatements concerning the industry had gained wide acceptance and instead of arguing about it, they funded and encouraged scientific and literary research which would bring out the facts and nail them with uncontrovertible authority. The result of this research has been published in a number of booklets and pamphlets which are available on request to the Foundation office at 21 East Fortieth Street, New York City, and which have been widely distributed.

Advertising Activities

Wide correspondence was developed with representative citizens and the Foundation files contain tens of thousands of current correspondence folders covering every part of the United States. The information and advice of these citizens was invaluable in confirming the course of Foundation effort, and the Foundation soon became the natural clearing house for most of the industry's official information. After preliminary ground work had been laid, and factual research and issuance was underway, the Foundation determined upon a program of advertising, now widely placed in newspapers and magazines. Its messages have dealt with the industry's economic and social values, the moderate qualities of fermented malt beverages, and the industry's desire that places where beer and ale are sold shall be as wholesome as the beverages themselves. The advertising messages vary in these, and the 1942 advertising keynote is "Morale." An immense fabric of wholesaler and retailer education and cooperation was built within the industry and is still expanding.

Results were so effective that industry self-regulation programs have become a permanent phase of Foundation activity and further developments of this program are constantly under consideration.

In 1938, the industry decided upon a further step to implement the advertising messages with an action program against the law violators. This is the "clean up or close up" effort which has been intensively organized in fifteen states to date . . . and is still expanding. The Foundation sponsors and supports self-contained Committees of brewers and beer distributors in each of these states, selects as State Director an outstanding citizen of highest character and reputation, staffs the organization with personnel chosen within the state for their standing and intimate knowledge of conditions, and begins investigating complaints and reporting results to the public. More than 50,000 such investigations have been recorded in the fifteen states alone. Where conditions are found to be bad, the retailer receives a warning from the State Director who gives him a

reasonable time to reply and correct the situation. The greatest effect has been in voluntary corrections, certified by re-investigations. Where conditions are not corrected, the Committee turns the case over to the public authorities and sticks with it until decisive action results.

Hundreds of revocations, suspensions, padlocks, and other forms of action are listed in the State reports. In other states where the program is not intensively organized as above, advertising is supplemented by less formal, but effective, industry cooperation with the public officials . . . and it is felt that the result has been a widespread and ever increasing improvement in the standards of beer retailing and the conditions in licensed places.

The Foundation has publications covering the history of beer dating backward nearly 6,000 years, bibliographies of the industry's literature, records of the "clean up or close up" program, scientific references to beer, and an economic textbook of the industry which is published annually.

Recent Beer Developments

Outstanding developments of 1941 included (1) expansion of the industry's program of cooperation with law enforcement officials to assure the maintenance of high standards of beer retailing, with emphasis on areas near Army, Navy and Marine posts in all of the states where such training camps are located, and (2) appointment of industry action committees to get behind the nation's war effort and make all necessary adjustments in its own economic and industrial structure.

The 550 breweries which operated during 1941 produced 60,520,000 barrels of beer and ale, of which 57,280,000 were withdrawn for sale. This compares with the 1940 production of 53,750,000 barrels and tax-paid withdrawals of 51,800,000 barrels.

Retail sales in 1941 were estimated at $2,000,000,000 with approximately 350,000 retail establishments including restaurants, hotels, taverns and grocery and delicatessen stores sharing in the proceeds.

For the second successive year, the volume of bottled and canned beer sales exceeded that of draught beer. Packaged beer accounted for 56% of the total, as against 25% in 1934 and previous years. The steady growth in packaged sales since 1934 is largely attributed to the increasing use of beer in the home.

What effect the war will have on the beer business remains to be seen, as the pinch resulting from priorities and rationing began to be felt about mid-summer of 1942. Raw materials used in brewing remain in abundance, as the United States grows these crops in surplus. Shortage of metals, however, has resulted in a total discontinuance of cans for civilian use after present retail stocks are used up. Cans represented 12 per cent of all packaged beer sales in 1941. The metal shortage has also resulted in decreased supply of crowns for bottles. To meet this situation, bottle sizes were standardized at 12 oz., quarts and half gallons. Many brewers are concentrating much of their advertising and merchandising on quart (32-ounce) sizes for home consumption.

Beer taxes collected by Federal, state and local agencies amounted to approximately $489,000,000 in 1941 on the basis of U. S. Bureau of Internal Revenue reports and industry estimates of state and local taxes for which no comprehensive reports are available. Of this amount the Federal Government's share was $348,876,726, a new record. The year's tax collections brought the beer revenue received by the Federal Government since relegalization to $2,269,656,-845 and the total amount paid into Federal state and local treasuries to more than three billion dollars.

The year's beer production consumed about 4 billion pounds of barley, corn, rice and

hops. Since beer's relegalization in 1933, the brewing industry has used nearly 33 billion pounds of domestic grain, purchased at an average annual cost of nearly $100,000,000.

Of great significance was the favorable improvement in the public's attitude toward beer in many states with strong dry sentiment. This was largely due to the Brewing Industry Foundation's cooperation with public officials in law enforcement.

* * *

Beeswax

COMMERCIAL removal of honey is a matter of centrifugaling the wax comb. The beeswax cappings over the cells of honey must first be removed. These cappings melted up together with occasional combs that are broken or otherwise unfit for further use, are the sources of beeswax. The wax is light yellow when first secreted by the bees but darkens on standing in the hive from contact with certain resins in the propolis. It may be bleached either with sunlight or through the use of chemicals. The melting point varies from 62° to 65° C.

The increased production of honey urged because of the sugar shortage means an increase also in the production of beeswax. On the average for every 100 lbs. of honey extracted from the combs, 1½ to 2 lbs. of beeswax may be produced from the cappings alone, the occasional combs being melted often amounting to as much more. War demands and the virtual embargo on many imported allied commodities offsets the increased output.

Beeswax is used for floor and other polishes, for candles and the protection of etchings. Artificial fruits and flowers are often made of beeswax as are many molded articles. In medicine it often enters into the preparation of ointments, and in cosmetics it is used in lip sticks and face creams.

Vegetable waxes and sometimes paraffin and stearine are sometimes added to beeswax for the commercial market.

Beeswax consists mostly of a mixture of crude cerotic acid and about 80% myricin. It has a honey like odor and a balsamic taste. It is insoluble in water, partly soluble in cold alcohol, and soluble in hot alcohol, chloroform, benzene, ether and carbon tetra chloride.

Principal grades or types are yellow, bleached yellow, and bleached or white.

In July 1942 domestic yellow was priced at 40¢ to 50¢ per pound.

* * *

Beet Pulp (Sugar)

BEET PULP is dried refuse from sliced sugar beets after the sugar is extracted. It is generally processed by the removal of about 70% of the moisture through pulp presses and the remainder of the moisture by steam or direct fire driers. As a by-product of the United States beet sugar industry it's production depends on the tonnage of beets sliced. Roughly, the pulp output is 5% of the beets sliced. It is used as a cattle feed, principally a dairy feed and it is marketed in 100 pound bags with a price range of from $1.00 to $2.50 per bag. Transportation is usually by railroad box-car. Under normal storage conditions it is non-perishable. The two principal types are "steam dried" and "direct fire dried." There are no substitutes. There is no import duty and there have been no recent imports.

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Belladonna

BELLADONNA is the dried leaves and flowering tops of Atropa Belladonna. Cultivation in this country is centered in California, while abroad it is found in southern and central Europe, Asia Minor and parts

of North Africa. U. S. production has not been satisfactorily estimated but formerly world production approximated 200 tons. Containing alkaloid atropin, its principal use is as a remedial agent in the treatment of a variety of diseases in the form of fluid extract or tincture. Externally, it is used as a counter-irritant in the form of plasters and ointments. It is usually marketed in bales, by the pound. Prices vary with the alkaloidal activity. The expected price for Fall of 1942 delivery will be about $2.10 per pound, in bags and barrels. It can be preserved for about two years, depending on the type of storage. Grades used for manufacture of alkaloid may be below U.S.P. quality while for medicinal purposes only U.S.P., or better grades can be used. Substitutes embrace almost any drug containing the same alkaloids, such as Stramonium. There is no U. S. import duty. Belladonna has considerable use in treatment of disease, making it obviously important to the armed forces. However, the war has interfered seriously with the source of supply and the "high price" has curtailed consumption.

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Benzoate of Soda

See Sodium Benzoate

★ ★ ★

Benzol

USUALLY a water-white liquid (C_6H_6) very volatile and highly inflammable. It's specific gravity is 0.878; boiling point 80.1° C.; is miscible in alcohol but not in water. It is produced by the distillation of light oil from by-product coke ovens. Approximately 125 million gallons are made in the United States annually. The uses range mostly through motor benzol, dyes, explosives, and synthetic phenol. It is an excellent solvent for waxes, rubber and other materials. It is marketed and transported in tank-cars or drums, with a recent tank-car price, 15¢ per gallon. Because it is volatile it is perishable. Principal grades are: Motor, 90 percent pure; and Nitration. Although there are no substitutes for benzol in the chemical field, alcohol and tetra-ethyl lead can replace it in the motor fuel blend.

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Bentonite

ALTHOUGH bentonite clay was used by pioneers in the west to grease the wheels of their covered wagons and instead of soap, it is a relatively new commodity in modern industry. Fifteen years ago the output was less than 5,000 tons as compared with domestic production in 1940 in excess of 250,000 tons. Imports are insignificant, averaging less than 50 tons annually.

A variously colored colloidal clay—soft, porous and moisture-absorbing—often of volcanic origin, its characteristics are described as "remarkable." By far the largest production of the swelling type—it will absorb five times its weight of water—is found in Wyoming and South Dakota. A type with little swelling property is mined in the south and, while not a substitute, is even better than the Wyoming type for certain kinds of castings.

Bentonite is important in the war production program, principally because of its use in foundry moldings and core sands. Oil refining, however, uses the most bentonite—the Mississippi non-swelling variety—which is acid treated or activated to convert it into an efficient bleaching agent. This industry used 95,300 tons, or 38 per cent of 1940 sales. Foundry and steel works bought 74,135 tons, or 30 per cent. Rotary well-drilling mud for the petroleum and natural gas industry consumed about 18 per cent of 1940 use while miscellaneous use, including cement manufacture, needed 36,301 tons.

Recently, more bentonite clays have been used as plasticizers; only a small quantity is

needed for an effective job. The use of 3 per cent bentonite as a bonding agent effectively adheres slurry in roof repair work. Increased use as a plasticizer are expected after the Krause patents expire. The use of bentonite as a plastic agent with highly refractory clays in the ceramic field is also increasing. The Mississippi bentonites adapt themselves best to the preparation of molding sands for casting metals.

The most widely used bentonite is 200-mesh powder, priced at $10.25 per ton f.o.b. Black Hills shipping point, in 100-pound bags, carload lots. However, Wyoming-type bentonite is also marketed in pellet form 30- to 40-mesh; and a finely dried and finely crushed product, mostly 4- to 20-mesh is sold in carload lots at $7.00 per ton in bulk and $8.75 in bags. In normal times, upwards of 30,000 tons of bentonite are exported, mostly acid-treated types for use by oil refineries throughout the world.

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Benzoic Acid

BENZOIC ACID is also sometimes known as phenylformic acid and is the simplest acid of the aromatic group. It occurs as white scales or needle crystals and has an odor resembling benzoin or benzaldehyde. It is slightly soluble in water and easily soluble in alcohol, ether, and the organic solvents.

Benzoic acid originally was obtained from gum benzoin by sublimation, or by treating the gum with milk of lime and then distilling with sulphuric acid. However, synthetic production has displaced the natural source. Most common process employed in synthetic manufacture uses toluene as the basic material. This is chlorinated to form benzotrichloride, heated with milk of lime to form calcium benzoate, and then reacted with a mineral acid to free the benzoic acid. It is also obtained as a byproduct in the production of benzaldehyde from toluene, wherein certain amounts of calcium benzoate are formed which are treated as above.

Commercially, benzoic acid is available in technical and a United States Pharmacopeia grade. The U.S.P. material must contain at least 99.3 percent of benzoic acid. It is packed in drums and barrels containing 50, 100, and 150 pounds; in 25-pound kegs; and in cartons and tins ranging from one ounce to five pounds in weight.

Benzoic acid is employed as an odorant and flavoring material in tobacco, as a perfume ingredient, as a mordant in calico printing, and in chemical synthesis. Its preservative and antiseptic properties also often are utilized in the preservation of foodstuffs. Such use must be declared on the label, and the quantity incorporated must not exceed 0.1 percent, calculated as sodium benzoate. In recent years the price of technical benzoic acid has been approximately 43¢ per pound; and the medicinal material, 54¢ per pound.

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Bergamot Oil

BERGAMOT oil is obtained by expressing the rind of the fruit of Citrus Aurantium and varo bergamia. Both are grown principally in Southern Italy and Sicily. The oil is brownish-yellow or honey colored, and may sometimes be tinted green by a slight chlorophyll content. Ripe fruit, from which the finest oil is obtained, is collected during November and December for oil production. The odor of bergamot is due chiefly to its content of limonene, linalyl acetate, linalool, and terpineol.

Because of its high cost, natural bergamot oil is often adulterated with turpentine, lemon and orange oils, and fatty oils. The distilled bergamot oil is obtained by distilling the leaves at the time of pruning, between February and April. Similarly, the high cost of the natural oil has resulted in the development of artificial bergamot oils,

having the same odor because of their high linalyl acetate content, and being much less expensive.

Approximately 84,633 pounds of bergamot oil, valued at $399,365, were imported into the United States during 1940. Of this amount 75,386 pounds came from Italy and Sicily. France contributed 6,868 pounds. In 1939, 211,181 pounds of the oil were imported. It is packaged in 25-pound tins and one-pound coppers.

Bergamot oil is used in perfumery, being prominent in eau-de-Cologne formulas, and lavender water combinations. Early in June, 1942, natural bergamot oil was bringing between $30.00 and $32.00 per pound. This price was also in effect at the start of 1942. On January 1, 1941, however, the market was approximately $20.00 per pound. Artificial products were priced between $2.25 and $6.00 on June 1, 1942.

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Beryllium

BERYLLIUM, sometimes known as glucinum in commercially pure form is an elementary metal belonging to the lighter-metal group. It is hard, brittle and crystalline. The specific gravity is 1.84; the melting point 1285° C.; and the hardness 6 to 7 on the Mohn scale, or nearly that of quartz. The ore, beryl, usually contains from 5 to 10 percent beryllium oxide, sometimes as high as 13 percent BeO. It is found in other ores but in minor quantities.

Beryllium production has been expanding rapidly. Most of the metal is produced as a 4-percent master alloy with copper in which form it is sold at $15 per pound of contained beryllium. Wrought beryllium alloys—which are made by remelting the master alloy and which are ready for fabrication—now range from 0.1 to 2.25 per cent in beryllium content. The base price for strip and other forms of the best known binary alloy, containing 2 to 2.25 percent beryllium, is 98¢ per pound when copper is 12¢. A fair amount of beryllium oxide is sold—chiefly as a super refractory. The high velocity of sound in beryllium, 2½ times that of steel, is one of its remarkable characteristics.

Mostly, however, it is alloyed with copper and the great strength of the alloy combined with good electrical heat conductivity and resistance to wear has led to its use in many industries. When properly heat-treated, beryllium copper exhibits a small amount of elastic drift or hysterisis. This characteristic has brought increased use where accuracy of spring properties are vital, as well as in the electrical field where maintenance of constant contact pressures is desired.

Apart from the price, which may be reduced with an expanded volume, extended use has been held back by the uncertainty regarding the supply. Domestic production of beryl has ranged in recent years from less than 100 to not more than 200 tons. From 50 to 100 tons of beryl are ground annually and used in certain types of pottery and ceramic wares. Domestic consumption in making beryllium oxides and alloys has not exceeded 300 tons. However imports of beryllium in 1940 rose to a new record—805 short tons valued at $23,865—of which 422 tons were from the Argentine, 377 tons from Brazil and 6 tons from South Africa.

The War Production Board by Order M-160 effective June 1, 1942 took complete control of the allocation of beryllium—ores, concentrates, alloys (containing 3% or more of beryllium), chemical compounds and scrap and secondary material containing commercially recoverable beryllium. However, until July 1, 1942 beryllium could be delivered to produce non-sparking cutting tools and hardened copper parts in airplane instruments.

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Betal Nut

See Catechu

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Bichromates

THE bichromates are also sometimes referred to as dichromates. Sodium, potassium, and ammonium bichromate are most important in that order.

Sodium bichromate is encountered as red, crystalline fragments. It is deliquescent. Manufacture of the salt is accomplished by fusing chrome iron ore in a reverberatory furnace with lime and soda and in the presence of air. Thereafter the material is extracted with water and acidified with sulphuric acid. The solution is then filtered, and concentrated so that the salt crystalizes.

Production of sodium bichromate during 1939 amounted to 54,385 tons, valued at $6,399,069. The 1937 output totaled 48,697 tons valued at $5,925,611. Since the salt is deliquescent it is packed in tight containers. These include casks containing 700 pounds, barrels holding 300 pounds; kegs of 100 pounds, and boxes containing 25 pounds.

The oxidizing properties of sodium bichromate are responsible for its use in many industries, including the bleaching of oils and fats, in chrome dyeing, and in dye manufacture. It is also used as the starting point in making many of the chromium salts and when reduced to the basic chromate in leather tanning. The price of sodium bichromate quoted on a contract basis was 7⅜¢ per pound on June 1, 1942. On January 1, 1941 a corresponding quotation was 6⅞¢ per pound.

Potassium bichromate occurs as clear yellowish-red crystals or a bright orange powder. It is produced by adding sulphuric acid to a crude potassium chromate solution, or by heating a solution of sodium bichromate with potassium chloride, concentrating until the salt is deposited and then lowering lead rods into the solution on which the bichromate crystalizes. Commercial packages for potassium bichromate are similar to those for the sodium compound. The use of the potassium and sodium compounds are also similar, the latter being more often used because of its lower price. Potassium bichromate on June 1, 1942 was quoted at 9⅝¢ per pound, and on January 1, 1941 at 8⅞¢ per pound. The output of potassium bichromate in 1939 was 4,690,734 pounds, valued at $404,024; and in 1937, 4,717,202 pounds, valued at $386,369.

Ammonium bichromate occurs as orange needles and is produced by the reaction of chromic acid and ammonium hydroxide. Production of the ammonium salt in 1939 totaled 47,956 pounds, valued at $15,579; and in 1937 amounted to 63,876 pounds, valued at $15,579; and in 1937 amounted to 63,876 pounds, valued at $28,434. It is shipped in 250 pound barrels, 100 pound kegs, and 25 pound boxes. The use of ammonium bichromate is much the same as the sodium and potassium compounds, when such use justifies the higher price which must be paid for the salt. It is sometimes used in fireworks and other pyrotechnics, since it decomposes readily on heating. The price of ammonium bichromate has been about 30¢ per pound in recent years.

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Birch Oil

BIRCH OIL, also called sweet-birch oil and betula oil, is a colorless or light yellowish oil obtained by the distillation of the bark and twigs of Betula lenta and other varieties of Betula. The oil is similar to the oil of wintergreen, since its chief constituent is methyl salicylate. The United States Pharmacopeia recognizes the similarity in its monograph on methyl salicylate, and standardizes both of the natural oils and synthetic methyl salicylate. It is specified, however,

that the source of material must be indicated on the label.

Northern and southern grades of birch oil are offered commercially. The northern oil is the more expensive and is obtained in the New England area, principally Connecticut. The southern oil is produced in Tennessee and other states in the southern Appalachian region. Occasionally, the oil is also distilled in Pennsylvania. The sweet birch tree from which the oil is derived grows throughout the Eastern United States from Canada to Georgia and Alabama, and westward as far as Minnesota and Kansas.

Commercially the northern oil is packaged in 25-pound tins and on June 1, 1942 was priced at $3.00 per pound. This price was also in effect on January 1, 1942. At the beginning of 1941, the northern oil was priced at $2.25 per pound. The southern oil is packaged in 25 and 28-pound tins, and on June 1, 1942 and January 1, 1942 was priced at $2.25 per pound. On January 1, 1941 the price of the southern grade was $1.55. The uses of birch oil, as well as wintergreen oil and synthetic methyl salicylate, are as a flavoring material, in odorants, and in medicine.

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Birdskins

BIRDSKINS are used for leather making in only very limited quantities. With the exception of ostrich skins, the skins of various birds are used only infrequently as novelty trimmings on high style shoes, and for similar purposes.

Ostrich skins are obtained from the skins of South African ostriches which are primarily raised for their plumes. The production of ostrich skins is limited and perfect skins are rare. They are tanned by the vegetable tanning process and are made into a light leather which is attractive in appearance and is distinguished by the quill holes, which are quite distinct in the finished leather. Ostrich leather is used chiefly for women's shoe uppers and sometimes for handbags.

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Bismuth

AN elemental metal (Bi) with a specific gravity of 9.8, bismuth is the poorest conductor of heat of all the metals except mercury and also the most diamagnetic. It melts at 271° C. and is characterized by the property of expansion when changing from a liquid to a solid state. When used in alloys, it reduces the melting point, is valuable for fusing, and imparts a hardness to lead and tin alloys. It is brittle and is grayish-white in color.

Complete official data on production, consumption and exports of bismuth and bismuth compounds are not available, but it is estimated that pharmaceutical and medicinal manufacturers normally use about 75 percent and low-melting-point and non-shrinking alloys the remainder. In 1940, a total of 123,880 pounds of bismuth including compounds, mixtures and salts, were imported —all from Peru, and it is reliably estimated that exports, the bulk to the U. K., Russia and France, reached about 600,000 pounds.

Bismuth production is mostly as a by-product in smelting lead and copper ores mined in and imported into the United States. Its production must have kept pace with the increased smelting of those metals.

Actual domestic consumption probably exceeds the 500,000-pound mark, due chiefly to its increased use in alloys.

The low-melting point and non-shrinking bismuth alloys are being more widely used in war industries in the manufacture of machine tools and dies, aircraft, and alloys. One low melting point alloy of bismuth, lead, tin and cadmium is being used in bending thin-walled aluminum alloy aircraft oil and

gas tubes. The molten bismuth alloy, poured into the tubes, will reveal any holes. As the filler metal solidifies when cooling, any weak seams in the tubing will split as the bismuth expands slightly on cooling. Also, the alloy can be melted out of the tube in steam or boiling water and reused.

Some production figures are available. In 1939, production of bismuth subnitrate totaled 365,522 pounds; bismuth subgallate 43,347 pounds; and bismuth subcarbonate 241,817 pounds. The various bismuth compounds, salts, and mixtures, are utilized in indigestion remedies, antiacid compounds, ointments, salves, dusting powders, venereal disease doses, and other medicinal applications.

New York quotations for bismuth metal remained firm at $1.25 per pound, in ton lots, in 1942 against a high of $4.00 in World War I. Bismuth compounds range in price between about $1.50 and $2.50 per pound.

* * *

Bismuth Salts

MOST important of the bismuth salts commercially are the basic compounds, termed "sub" or "oxy" salts. They are used principally in medicine. Specifically, the most important compound is bismuth subnitrate, or oxynitrate. In 1939, 365,522 pounds of the subnitrate were produced by six plants in the United States. In comparison, production in 1937 by the same number of plants was 262,867 pounds. The value of the amounts shown was $487,502 and $309,678, respectively.

Bismuth subnitrate, according to United States Pharmacopeia is a white powder, insoluble in water, which contains not less than 79 per cent of bismuth trioxide. Commercially it is packed in drums containing from 25 to 250 pounds, cans and bottles containing 5 pounds, and one-pound bottles. The price of the subnitrate on June 1, 1942 was $1.20 per pound. This price was also in effect at the start of 1942. On January 1, 1941, the material was quoted at $1.48 per pound.

Second most important bismuth salt, as to quantity produced is bismuth subgallate. In 1939, six establishments in the United States produced 43,347 pounds of the material, valued at $62,285. In 1937, the same plants manufactured 40,861 pounds, valued at $55,-270. Commercial packaging practice for the subgallate is similar to the subnitrate. The price of bismuth subgallate on June 1, 1942 and January 1, 1942 was $1.40 per pound. On January 1, 1941 it was priced at $1.68 per pound.

Bismuth subgallate is a bright yellow powder, also insoluble in water. The United States Pharmacopeia grade yields 52 to 57 percent of bismuth trioxide on ignition. Other bismuth salts official in the U.S.P. are bismuth subcarbonate, bismuth subsalicylate, and bismuth and potassium tartrate.

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Bituminous

See Coal

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Black Lead

See Graphite

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Black Malt

See Beer

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Blacking

See Graphite

Blackstrap Molasses

A BY-PRODUCT in the manufacture of sugar, from cane or beet, blackstrap molasses is the final liquor from which no further sucrose can be extracted although it usually tests about 55 percent surgars by weight.

Its production depends directly on the amount of sugar made, i.e. when Cuba makes a crop of two million tons the production of blackstrap is half of that which is obtained when Cuba makes four million tons. Aside from blackstrap obtained domestically from the production of beet sugar and cane sugar in continental United States, the principal source of supply for the United States has been Cuba. In 1941, Cuba produced over one hundred million gallons of blackstrap and this year's production (which the Cuban government will not disclose) is expected to be at least 50 percent higher. There is also a small amount of refiners' blackstrap obtained in the refining of raw cane sugar here.

Blackstrap's principal uses in the United States have been as a source of industrial alcohol, although high-test molasses has been utilized to a greater extent for that purpose during the last few years. (See High-Test Molasses article.) Blackstrap is also used as a constituent in grass silage and roughage for livestock.

Not so many years ago, blackstrap was so much of a drug on the market that talk of dumping it at sea was heard. Prices, then, were in the neighborhood of 4¢ per gallon landed at New Orleans. In mid-1942 the price was about 16¢ per gallon and sugar mills for the first time in history were being compelled by the government to share with producers on the income from molasses resulting from the processing of producers' raw sugar.

The War Production Board, by Order M-54, effective Dec. 31, 1941 (amended March 27 and May 25, 1942) restricted the deliveries and use of all types of molasses.

In 1941, Louisiana producers made 20,895,000 gallons of blackstrap molasses against 16,306,000 in 1940 while Florida's production yielded a further 5,157,000 gallons against 5,170,000 in 1940. Cuba, in 1941, exported 101,913,077 gallons which, except for a small amount taken by Great Britain, all came to the United States.

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Blue Crabs

See Crabs

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Bluefin

See Tuna

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Bone Black

BONE BLACK is an animal charcoal, occasionally referred to as "Ivory black" or "Drop black." It is processed from selected bones which have been freed of fat, crushed, and then charred at high temperatures in a closed retort. The char is fully ground and refined by air filtration. Our supply is produced within the country, running to about 5 to 6 million pounds annually. It is used as a black pigment for: artist's colors, artificial leather finish, black japans, casein paint, calsomine, case hardening of steel, linoleum, lacquer, phonograph records, paints, printing ink, pulp colors, silk screens, process inks, water colors, water base inks, wall papers, etc. It is marketed by the pound or by the barrel, being shipped by the barrel or the bag. The price, depending on grade, quality and destination, ranged from about 8½ to 20¢ per pound recently. It is chemically stable, does not deteriorate with age. There are various types, of different color and strength. It is rated in plentiful supply and may be substituted in some usages. The U. S. duty on imports is 20%.

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Borax

BORAX is a white crystalline or powdered chemical — hydrous sodium borate ($Na_2B_4O_7 \cdot 10H_2O$). It's specific gravity is 1.75; it melts at 1700°F. Containing 47.2% water, it is readily soluble in water. Production in the United States is estimated at about 150,000 tons, mostly mined and refined in California. Principal uses are as a base in making porcelain enamel and glazed and in making glass. Industrial uses include porcelain enamel, glazes, glass, fluxes, preservatives, fertilizer, tanning, adhesive, starch, soaps, tool and machinery, tile, pottery fluxes in smelting and soldering, as a scouring and cleaning agent, and as an antiseptic and preservative. It is normally marketed in bags of 100 pounds. Refined Fine Granulated is priced at $45.00 per ton; Refined Powdered at $50.00 per ton, in carload lots of 40 tons or more, packed in sacks, f.o.b. California, with freight allowed. Borax is non-perishable. There is no U. S. import duty.

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Boric Acid

See Boron

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Boron

THE United States produces about 90 percent of the world's supply of boron materials. Boron is an element resembling silicon, only used in compound form. It is the source of borax and boric acid, among other materials. When pure it has a specific gravity of 2.45 and will burn with a brilliant flame at 600° C. (see Borax).

In 1940, 243,355 tons were sold or used by the boron-mineral industry, valued at $5,643,390. Exports, which have since fallen off sharply, totaled 64,313 tons valued at $2,456,523.

Requirements of boric acid and borates for the manufacture of heat-resisting glass and for vitreous enamelware have been steadily increasing. Both industries are important consumers of borax. The use of boron in fertilizer, though not large as yet, is reported growing. Active research has developed the fact that there is a different and a relatively narrow range of optimum concentration for each type of plant.

Calcium boride, by electrolytic production, has been used to some extent in metallurgical work as a source of boron or as a deoxifier or degasifier of molten metals. Attempts are also being made to improve the methods of recovering boron minerals from their ores.

A process for the recovery of a relatively high grade of crude boric acid by treatment of ground ore with sulfur dioxide and water, followed by flotation of precipitated boric acid, has been described by the Bureau of Mines.

Boron carbide, a black, opaque, crystalline material, is produced in the electric furnace from fused boric oxide and carbon. It is the hardest commercial man-made material. It is used in the form of fine powders for lapping and polishing, and as a source of boron in special steels and alloys. Self-bonded, under high pressures and temperatures, it is used extensively as liners for pressure blast nozzles.

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Boron Carbide

See Boron

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Bortz

See Diamond Dust

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Bourbon Whiskey

See Distilled Spirits

Boxwood

BOXWOOD is the product of a tropical tree, cut in the forests of Venezuela. The United States imported about 500 tons in 1941. Its principal uses are for shuttles, rulers, novelties, piano actions. It is marketed by the long ton with 1941's average price about $55.00 ex-dock. It is highly perishable, three month's storage being about the limit. Only one grade is imported, i.e., "First quality." Composition or plastics can, of course, be used as substitutes for many of its uses.

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Brandy

See Distilled Spirits

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Brass

BRASS is an alloy of copper and zinc and its great importance is due to its high resistance to ordinary corrosive agencies and the very wide range of properties that may be imparted to it by variations in the proportions of constituents and by variations in mechanical treatment and heat treatment. Copper is always dominant.

Because of the relatively low temperature at which it melts, brass is employed for castings, large and small, but it is most useful in the wrought state.

Brass manufacturers produce rods, wire, sheet, strip, pipe and tube. Some fabricators use these products for the manufacture of a wide variety of articles, including everything from large special parts for condensers to street car tokens.

Because of its ductility and resistance to corrosion, brass is preferred metal for shells and casings.

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Brazil Nuts

THE Brazil nut is an oily, three-angled nut, the seed of the Brazil nut tree. The large globular fruit is a woody capsule containing 18 to 24 closely packed nuts, which are harvested and washed for commercial use. As might be judged from the name, this nut is grown only in Brazil.

Brazil nuts are imported in both shelled and unshelled form. They are marketed both for direct consumer use and in manufacturing, in the confectionery and baking trades, principally the former. In recent years, candy makers have been using Brazils to an increasing extent due to shortages and high prices for other imported nuts.

Notwithstanding the shipping stringency, continued imports from Brazil even on a curtailed basis are in prospect during the war years.

Commercially, Brazil nuts in the shell are graded Large Medium, Large Washed Manaos, and Large Polished. Shelled grades are Broken Brazils, Chipped, Large Whole, Medium Whole, and Midget Whole.

Imports from Brazil in 1941 totaled 12,000 tons of nuts in the shell and 140,000 cases (each of 66 pounds) of shelled Brazils.

The unit of purchase by the importer is the pound. Unshelled Brazil nuts are packed in 100 or 180-pound burlap bags and to a limited extent in 40-pound basket; shelled are packed in 66-pound wooden cases.

Latest quotations for unshelled are 17 cents for Large Medium and 19 cents for Large Washed. No quotation for Large Polished is available. Shelled Brazil nut values in July were: Broken, 33½ cents; Chipped, 34 cents; Large Whole, 34½ cents; Medium Whole, 35 cents; Midget Whole, 36 cents.

Brazil nuts are distributed from import ports via either rail or truck. The nuts are semi-perishable and are generally marketed during the period of the crop year to guard

against spoilage. They require storage in cool places.

As substitutes commercial users utilize walnuts, almonds, filberts, or other acceptable types in more liberal supply or more attractively priced.

The import duty is 2¼ cents a pound for shelled and three-quarters cent for unshelled.

The sale of Brazil nuts is under the limitations of the General Maximum Price Regulation.

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Brazil Wood

BRAZIL WOOD is a "dyewood," also a fancy wood, imported as hewn logs. It is found growing wild in the forests of tropical America, principally in Nicaragua, Mexico, etc. Supplies are normally limited only by the demand and consuming market values. It has a rich, bright-red color and takes a fine luster polish. It is used for fine furniture, violins, etc.—and also is the base for a dye pigment, producing purple and crimson shades. Silk dyers use the manufactured extract more than other industries. It is marketed by the ton but price and grades are not established on a stable trade basis. There is no U. S. import duty when imported as "hewn logs."

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Brazil Wax

See Carnauba Wax

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Brewer's Chips

See Corn Sugar

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Brick

BRICK, when used as a structural and road building material, is a small unit, solid or practically so, commonly in the form of a rectangular prism, formed inorganic, non-metallic substances and hardened in its finished shape by heat or chemical action.

In the present state of the art, the term brick, when used without a qualifying adjective, should be understood to mean such a unit, or a collection of such units, made from clay or shale hardened by heat. When other substances are used, the term brick should be suitably qualified unless specifically indicated by the context.

The shales or clays from which brick are made are won by surface digging, quarrying or mining depending upon the location and nature of deposits. These are available in every state in the U. S. The greatest concentration of plants occurs in a belt extending from the Atlantic Coast through Pennsylvania, Ohio, Indiana and Illinois and on through the Middle West to Colorado. Texas and the Southwest also produce brick in large quantities.

In 1941 approximately 5 billion brick were produced in the U. S. This was 60% of the capacity of the brick industry. Brick is used in all types of construction for roads or floors, for load-bearing or curtain walls, both interior and exterior, for architectural appearance as finish or for foundations below grade. Brick masonry may be plain or reinforced.

Brick is marked and quoted by the thousand units. Transportation is by rail, motor trucks and water. Brick is not packed in containers except in the case of glazed or ceramic brick which is packed in cardboard cartons or wooden boxes or barrels. Brick is practically imperishable and is probably the oldest of our building materials.

Principal types are smooth face brick, textured face brick, common brick, ceramic glazed brick, salt glazed brick, and paving brick.

Imports are practically negligible.

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Bromine

BROMINE is a dark, brownish-red fuming liquid. The fumes are irritating and poisonous if inhaled and the liquid itself burns the skin. It is slightly soluble in water, forming "bromine water," and is readily soluble in ether, alcohol, and similar solvents.

The brine wells used for the commercial production of ordinary salt was previously the principal source of bromine, and still furnishes important amounts of the material. The wells located in Michigan are particularly rich in bromine. Isolation of the bromine from the brine is accomplished by electrolysis, or by displacing the bromine with chlorine, the bromine being liberated as a vapor which is then condensed in suitable apparatus.

The growth of the anti-knock gasoline industry, however, demanded considerable bromine in the form of ethylene dibromide and lead to the large scale extraction of bromides from seawater. Large installations doing such extraction are located at Wilmington, N. C., and at Freeport, Texas. In the process, the seawater is also treated with the more active chlorine, and the bromine liberated with aeration. The bromine as it is displaced, is reacted with ethylene, to form ethylene dibromide.

Commercially, technical and medicinal grades of bromine are offered. The technical material contains varying amounts of chlorine, bromoform, and hydrobromic acid as impurities. Purification is usually accomplished by shaking the impure material with an alkaline bromide, such as potassium or calcium bromide, and redistilling.

The production of bromine in the United States during 1940 totaled 29,633 short tons, valued at $11,772,515. In 1939, the output was 18,941 short tons, valued at $7,611,400. The enormous increase is attributed to the fact that during recent years more and more of the ordinary, or regular, gasolines were improved by larger additions of knock-inhibiting compound. The United States is the largest producer of bromine. Germany and Palestine are also important producers, and appreciable quantities are also produced in Japan, France, Tunisia, Italy, Russia, and the United Kingdom.

Fourteen United States plants produced bromine in 1940. The largest quantity being produced at the seawater extraction plant in North Carolina. Michigan brines furnished the second most important source. Production of bromine from the brines of Searles Lake, Calif., was also reported in 1940 for the first time in important volume.

The manufacture of anti-knock compounds for gasoline is the most important use of bromine. Other important uses are in the manufacture of bromides, hydrobromic acid, oxidizing agents, and other chemical compounds; in metallurgical refining; in military gas manufacture; and in disinfectant combinations. The price of bromine in recent years has been about 25¢ per pound.

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Bronze

See Copper

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Buckeye

See Hardwoods

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Buckwheat

BUCKWHEAT is an herb long cultivated as a food plant, thriving even on poor soils. The triangular seed of the plant is ground into flour. Buckwheat flour contains considerably less protein than wheat flour, but nearly as much as corn meal or rice. Domestic production supplies the market. Buckwheat flour has a distinctive flavor, is grayish in color, and is often mixed with wheat mid-

dlings to soften the flavor, It is milled largely for use as a pancake flour.

Buckwheat is also made into groats and grits.

Buckwheat is bought by the millers by the bushel. When milled, the flour is packed in 100 pound bags or barrelled; and some is packed in 25 pound bags. Groats and grits are packed in 100 pound bags.

Buckwheat products may be shipped by either rail or truck. They require dry storage to prevent quality deterioration, or insect infestation.

July, 1942, market values were: Grits, Fine, medium and coarse, $6.00 per 100 pounds for white; $7.00 for brown; $10.00 for hearts; Extra Coarse, white, $6.00; Whole, white, $7.00; brown, $8.00.

Buckwheat flour is currently valued at $4.00 per 100 pounds, packed in 100-lb. bags. The 25-pound bag generally carries a premium of about one-quarter cent per pound over the larger unit. For consumer use, buckwheat flour is packed in 20-ounce cartons, sold per dozen, with prices varying considerably as between competing brands.

The import duty on buckwheat flour is one-half cent per pound, with a similar duty on grits or groats. Hulled or unhulled buckwheat is subject to a tariff of 25 cents per 100 pounds.

No price ceiling on quantities in excess of 3 pounds applies.

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Buffalo Hides

BUFFALO HIDES used for making leather are taken from domesticated land and water buffalo common in several foreign countries. The hide of the American bison is not used for leather.

The production of buffalo hides and their consumption by the leather industry in the United States varies considerably from year to year, although in recent years these hides have been used for a wider variety of leathers than heretofore, and it is thought that consumption after the war will be more uniform and substantially greater than in pre-war years.

The domesticated buffalo is very common in India, where it is used as a work animal, and it is also quite common in China, Dutch East Indies, Siam, Indo-China, Egypt, Turkey, Formosa, and the Philippine Islands.

The leather made from buffalo hides has a distinctive rough grain and it is commonly used for buffing wheels, luggage, and handbags. Large quantities are used for manufacturing rawhide for mallets, gears, and mechanical uses.

In comparatively recent years sizeable quantities of buffalo leather have been used as a substitute for cattlehide leathers in shoe soles and uppers.

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Bull Hides

See Cattlehides

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Buna N.

See Synthetic Rubber

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Buna S.

See Synthetic Rubber

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Burlap and Jute

JUTE, the raw material of burlap and other products, is the "glossy fibre of either of two East Indian tiliaceous plants." It came into commercial use less than a century ago and is now one of the leading fibres in world textile consumption. Jute is indigenous to Bengal, India, and neighboring provinces, which together produce

about 99% of the world's annual supply. Principal manufacturing centers are Calcutta and Dundee, Scotland. Most of the United States imports are in the form of finished burlap cloth.

The jute crop is quick-growing and exhaustive to the soil. It is a bast fibre; in other words it is the inner bark of the plant lying between the outer bark and the pith. The mature plants stand from 5 to 16 feet high and grow best in a damp heat. Preparation of the soil begins in March and April, and cutting commences from July through October.

After harvesting, the plants, in bundles, after standing a few days in the open air, are thrown into pools of still water and submerged with sods, until the gummy matter surrounding the fibre ferments, which takes from 10 to 20 days. As only about four or five per cent of the plant's original weight is fibre, an enormous quantity of green crop has to be so retted; the same pools have to be used over and over; and so the later fibre is not as good as the first.

After retting, the stalks are beaten and the bark and fibre stripped from the pith. Then the jute is dried over bamboo frames and tied into bundles for the market. Care is necessary here, as excessive sun exposure may discolor the fibre, and color is of trade importance.

A strand of jute appears as a silky hair, minute and fragile, several feet long. But like all bast fibres, it is a bundle composed of several units cemented together, each shaped like a hollow spindle. In determining the effective use of a fibre for spinning, it is usually the average length of the units which matters. In flax and hemp this varies from a half inch to an inch and a half, but in jute it is from one-eighth to one-half inch. To spin the units into a coherent yarn is not commercially practicable, and so very fine jute yarns are spun only by a few highly skilled manufacturers. The processes usually employed are roughly similar to those used for cotton and wool, but not so refined.

When the jute gets to the plant in the highly compressed *pucca* bale it is loosened and blended in a bale breaker, and the heads crushed out. Then it goes through a softening machine, a series of rollers arranged horizontally in a long, narrow frame. Here it is further separated and loosened, and sprayed with an oil and water emulsion to make it more pliable.

Then it stands for 24 to 48 hours in boxes so that the emulsion may permeate it.

The jute then goes to a breaker—a large central cylinder and two or three pairs of smaller ones, revolving at widely different but carefully inter-related speeds, with surfaces completely covered with strips of wood into which steel pins are inserted at an angle. The jute is torn and broken, combed, and made somewhat parallel, coming out as a web which is condensed into a ribbon or "sliver" and collected in a can. The card or finisher is like the breaker except that there are more cylinders and the pinning on them is finer, producing a more refined sliver.

The "drawing frame" next refines the sliver still further by drawing it out longitudinally. Two, three and even four drawings are used, depending on the fineness desired.

The roving frame, last machine of the preparing series, combines a drawing with a twisting motion and finally winds the now thin sliver on bobbins, and is a complicated and ingenious mechanism.

The jute spinning frame then converts rove into yarn by the action of flyers which rotate, put the final twist into the material, and again wind it on bobbins. When full, the bobbins are removed by the spinner and her helpers or by squads of doffers.

The spun yarn must now be put in some larger package more convenient to ship and

handle; so it is wound in skeins, cops, tubes or other shapes determined by the requirements of a subsequent process or by convenience in packing. Skeins are made by leading the yarn onto revolving reels, and are convenient for dyeing. Tubes are large cylinders or cones of closely wound yarn, built on a winding frame.

Some products are plied—that is, two or more yarns are twisted together. Two or more ends are led down to a flyer which twists them together and deposits the plied material on a bobbin. The plied yarn is then wound into the desired package as is single yarn.

All twines ("string") fall into one of two groups—finished and unfinished. Jute twine is a number of plies of jute yarn twisted together. These may be converted into heavier cords by twisting several of them together. Finished twine is polished, coated with thick paste, scrubbed, dried, and polished again.

Most jute yarn goes into rough jute cloth of one or two kinds—"hessians," "generally called burlap in America, or "sackings." The difference is primarily one of fineness, the burlap being made from medium-sized yarns, the sackings from coarser and lower qualities.

The United States imports comparatively little jute in the form of jute, most imports consisting of the final product—burlap. Imports of burlaps in the pre-war years, 1935-39 inclusive, averaged about 527 million pounds annually.

Chief use of the burlap is for bags and wrapping of bulk commodities. It has often been called "the wrapping paper of the wholesale trade." In this connection it is used for sacking sugar, coffee, flour, feeds, fertilizer, cocoa, rice, salt, grains, seeds, etc.

The linoleum industry depends upon certain types of this fabric for the foundation of its products, while large quantities are used for the backs of fringe rugs, spring mattresses, upholstery of furniture and in the automotive industry. Jute fibres are also used in the making of bedroom slippers, infant footwear, window curtains and drapes, wall-board, artificial hair and wigs, and book covers and binding.

The war has wrought great changes in consumption. Burlap was placed under complete government control December 22, 1941. Civilian uses, except for agriculture and chemicals, were curtailed and supplies regulated. It was decreed that two-thirds of imports must go into a government stockpile. This order was amended later to allow importers and bag makers to use burlap to fill certain priority rating orders and on Army and Navy orders for sandbags or camouflage cloth. Later it was stipulated that burlap (except Hessian cloth types) could only be used for agricultural bags or for defense orders carrying high priority ratings.

Burlap is sold by the yard. The New York price (40 by $10\frac{1}{2}$'s) averaged 11 cents per yard during the first four months of 1942. This represented the maximum selling price set by the OPA. Transportation is by rail and boat. Burlap is classified into A, B, C and D groupings as designated by the Calcutta mills.

The main domestic substitutes are cotton osnaburgs and sheetings. A number of fibers produced in Brazil and other South American countries are potential substitutes but lack of weaving facilities constitute a barrier to large scale production. Jute enters the country free of duty but unbleached, uncolored burlap is subject to a duty of 1 cent per pound and an additional 10 percent is levied on bleached, colored, etc. burlap.

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Butadiene

See Synthetic Rubber

Butanol

BUTANOL (Normal Butyl Alcohol) is a medium boiling alcohol, fourth in the series of primary monohydric alcohols. It is a water-white liquid with a non-residual odor. The chemical formula is $CH_3(CH_2)_2CH_2OH$. A major part of Butanol used in the United States is produced by special selective fermentation of starch or sugar under carefully regulated conditions. It is also produced synthetically. Only a very small percentage of the annual consumption is imported. Approximately 165 million pounds of Butanol were produced in the U. S. during the 1940 fiscal year, of which approximately 61.5 million pounds were sold as Butanol, the balance being used by the producers in further chemical manufacture.

Butanol is a good general purpose organic solvent. It is miscible in all proportions with most of the common organic solvents. Because it forms a constant boiling mixture with water, it can be used as a dehydrating agent. This constant boiling mixture boils at about 92° C. and in vapor stage, the approximate composition is 37% water and 63% Butanol. A large tonnage of Butanol enters into the manufacture of nitrocellulose lacquer. It is a latent solvent for nitrocellulose and a solvent for ethyl cellulose as well as most of the resins except the hard copals and the ester-soluble resins. It also serves as an excellent blending agent in nitrocellulose laquers. Important other chemicals using Butanol are: Butyl Acetate and Butyl Phthalate. Other products include Butyl Aldehyde; Butyl Amine; Butyl Lactate; Butyl Oxalate; Butyl Propionate; Butyl Stearate; Butylene; Butyric Acid; Dibutyl Aniline; and Dibutyl Tartrate. Butanol is also used in the manufacture of artificial leather, airplane dopes, drugs, dyestuffs, etc. It is marketed in railroad tank cars, truck tank wagons, 55-gallon and 5-gallon steel drums, and 1-gallon cans. Butanol is sold by the pound and weighs 6.76 pounds per gallon at 20°C. The current ceiling price is 15.8¢ per pound for tank cars, 16.8¢ for drum carloads, and 17.3¢ for LCL 55-gallon drums. It may be stored indefinitely. It is combustible but not flammable—flash point over 80° F.

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Butter

BUTTER is the fat obtained from cream by churning. In the modern butter factory, the cream is first pasteurized and, if it is sweet, it may be churned into what is called sweet cream butter, of mild flavor and aroma. Or, the sweet cream may be "ripened." The ripening of cream is a process of carefully controlled fermentation and is usually accomplished by the addition of "starter." This starter is a culture of pure lactic acid bacilli, and its function is to produce acidity and enhance the final flavor of the butter. The ripened cream is held overnight and is then ready for churning. (During the fall and winter season, when cows are likely to be off grass feed, the cream is naturally lacking in color. In order to maintain a uniform color throughout the year, harmless food coloring may, if required, be added to the cream before churning.) By far the largest proportion of creamery butter, however, is made from clean-flavored, naturally-soured cream, and its characteristic flavor and aroma are widely appreciated.

The operation of churning is the same for sweet cream, ripened cream, and soured cream. The function of the churn is to make the fat globules coalesce and form butter. The churn of today is a large cylinder of wood, which is revolved on a horizontal axis by motor power. Inside the churn are "rolls," baffles, or vanes. As the churn is revolved, the cream is agitated until the butter begins to "come." This requires perhaps

45 minutes. The buttermilk is then drained off through a valve, the last portion being washed out with clean water. Salt may be added to the butter granules, if desired, before working. The churn is then closed again and revolved slowly for possibly ten or fifteen minutes. This is called "working" the butter. This working operation removes excess moisture and gives to butter its characteristic "body" or consistency.

After being worked the butter is molded into prints or packed in tubs or boxes for the market.

The Federal standard for butter requires that it contain not less than 80.00% fat. The moisture content of butter is commonly in the neighborhood of 16.00%. Salt content is a matter of trade preference and may be from 1.5% to 2.5%. The casein or curd content may be in the neighborhood of 1.0%.

The rise and fall of butter output from year to year tends to parallel changes in the volume of milk produced, since fluid milk consumption is quite stable from one year to the next and other dairy products competing with butter for the use of butterfat are normally less important. Milk flow depends on the number of cows on farms, supplies of feed available, pasture conditions, weather, and the attractiveness of returns from milk as compared with beef.

Government price supporting measures, entailing large purchases of dairy products during the past few years, have been important production stimulants. Output of milk and many manufactured dairy products have reached hitherto unsurpassed levels during this period. Late in March, 1942, the Department of Agriculture announced it would support butter prices at a minimum of 36 cents a pound for 92 score, carlot basis at Chicago, with comparable prices for other grades.

The volume of creamery butter production shows a large seasonal swing. Output in months when milk flow is heaviest, May, June and July, average 40 percent more than churnings in the slack months, November through January. These green pasture months account for one-third of the year's supply. A better equalization of amounts reaching consumers each month is secured through storing about 30 percent of the spring output for use in the fall and winter.

Because of the large seasonal swing in production, middlemen attempt to distribute butter to the best advantage in time by storing each spring an amount equivalent to about 10 percent of the annual production. May, June and July are the preferred storing months, while the chief period of withdrawal is from November through January. Butter is seldom carried over into a second year because of large quality and price discounts incurred.

The leading producing states are Minnesota, Iowa and Wisconsin. Butter is produced primarily for use in the human diet.

The marketing unit is the pound. Wholesale and retail trade containers differ in size and materials, so it is usually up to the wholesaler to package or arrange the packaging of butter for the consumer. Wholesale shipping containers for both domestic and foreign bulk butter are most commonly round woden tubs, firkins or boxes. In Eastern and Central United States, the 63 pound tub is the preferred container while on the Pacific Coast a 68-pound cubic box is more generally used. The consumer usually obtains his butter packaged in rolls or rectangular bars ranging in weight from a quarter-pound to two pounds. The price per pound in New York early in June, 1942, was 37 cents per pound for 92 score.

Transportation is mainly by rail and truck.

Although butter is a perishable product, it can keep for many months if stored properly. In fact, butter stored in the spring is usually kept in storage about 6 months or

more before withdrawal in the following fall and winter.

Butter quality shows a considerable variation as a result of differences in the quality of cream used in manufacture, conditions of manufacture, age and method of handling after leaving the factory. Factors considered in quality determination are flavor, body or consistency, salt-content, odor and presence of extraneous matter.

In the past few years the Department of Agriculture has brought uniformity on a national scale through the definition of federal grades and the inauguration of a federal inspection system. All important exchanges now use federal grades. Under the federal scheme quality is assigned a score, running from 85 to 93. Over 93-score is a single classification and under 85-score is not given a grade.

The chief substitute for butter is margarine. The duty on butter is 14 cents a pound.

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Butternut

See Hardwoods

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Butyl

See Synthetic Rubber

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Cabretta

See Sheepskins and Goatskins

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Cadmium

A SILVERY-WHITE metal resembling tin. It is a very ductile metal which can be readily rolled or beaten into thin sheets. It is obtained as a by-product from zinc and lead refining. Electrolytic cadmium is 99.95 per cent pure. Cadmium has a specific gravity of 8.6; melts at 608° F. and boils at 1580° F. For a corrosion-resistant coating for iron or steel cadmium plate is about equal in effect to a zinc coat of the same thickness. Among its advantages are higher resistance to tarnishing, absence of bulky corrosion products which interfere with the working of mechanical devices. Ability to be soldered to with non-corrosive fluxes. Cadmium plate is widely used also in copper and its alloys.

The United States ranks first in world production. Mexico, Germany, Canada, Poland, Norway, Australia, Belgium, United Kingdom, France and Southwest Africa also produce considerable amounts of cadmium. Plants located in Colorado, Idaho, Illinois, Maryland, Missouri, Montana, Ohio, Oklahoma, Pennsylvania, Kansas and Utah account for most of the production in the United States.

World production in pre-war years averaged about 8.8 million pounds annually. The United States accounted for slightly more than 50% of this total. Domestic production increased considerably with the war and United States 1940 output was well over 6 million pounds.

The principal uses for cadmium are for electroplating, steel back bearings, and pigments. Cadmium also is consumed in copper trolley wire, in rolled plates for locomotive fire boxes, castings in electrical apparatus, fusible alloys in fire-extinguishing devices, solders, stereotype plates, accumulator cells and glass manufacture; and as a deoxidizer in alloys of aluminum, silver, and nickel. At this time most of the cadmium is used for plating for military uses, especially on parts used in aircraft or naval vessels, in instruments, bombs, ammunition boxes, communication apparatus, etc.

Cadmium is sold by the pound in commercial sticks (about 12 inches long). It is also sold to the plating industry by the pound as anodes of patented shapes. During the early part of 1942, anodes sold at about 95¢ a lb. The tariff is 15¢ per lb. and 7½¢ per lb. on imports from Canada.

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Caffeine

CAFFEINE is derived from a number of sources.

United States production in 1942 is estimated to be about as follows: 800,000 lbs. from cocoa, by methylation of theobromine; 250,000 lbs. extracted from tea; and 200,000 lbs. obtained in the decaffeination of coffee. In addition to the above, hardly more than a few thousand pounds will be derived from mate and perhaps an equal amount from coffee soot, which is produced in the roasting of coffee. Mate is a relatively expensive raw material as it contains only slightly more than 1 per cent caffeine, whereas tea from Northern India contains 3½ to 4 per cent.

The War Production Board estimates the caffeine requirements for 1942 at 1,400,000 pounds, divided as follows: medicinal 100,000 pounds, other health supplies 250,000, lend-lease 200,000, beverages 850,000 pounds. The soft drink industry, mainly the cola beverages, are the main consumers of caffeine but they hold their caffeine content well below that of beverage tea and coffee.

Recently Chile was reported planning to produce 2,000 kilograms annually from imported coffee. In Brazil, a plant has been built under the supervision of an American engineer to extract caffeine from coffee and convert the residual coffee into plastic. Other valuable by-products are also expected to result from this operation.

In mid-1942, citrated caffeine was quoted at $2.30 per pound.

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Cajeput Oil

CAJEPUT, or cajuput oil, is distilled from the fresh leaves and twigs of several varieties of Meleleuca Leucadendron found growing in India and the East Indian area. The crude or technical grade is green or bluish-green in color. When rectified, the oil is yellowish or colorless.

The Netherlands Indies supplies all of the cajeput oil imported into this country. In 1940, 15,652 pounds, valued at $5,394, were imported. During 1939, 25,930 pounds, valued at $7,156, were imported. Commercially technical and U.S.P. cajeput oils are packed in 50-pound tins. A high-quality, re-distilled oil is packed in 25-pound tins. Cajeput oil is used in perfumery and medicine.

The price of technical cajeput oil on June 1, 1942 was $2.10. At the beginning of 1942 and 1941, respectively, it was $1.75 and 65¢ per pound. The Pharmacopeial grade similarly increased in price as war conditions made the raw material scarce. On June 1, 1942, the U.S.P. grade was priced at $2.15 while at the beginning of 1941 it was priced at 75¢ per pound. The re-distilled oil was $2.45 per pound on June 1, 1942.

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Calamine

See Zinc

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Calcined Soda

See Soda Ash

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Calcium Boride

See Boron

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Calcium Stearate

CALCIUM STEARATE is a fine white powder, insoluble in water, but soluble in alcohol and ether. It is produced by reacting sodium stearate with a soluble calcium salt, such as calcium chloride. The calcium stearate, upon the completion of the reaction, is filtered off and dried. It is packed in

wooden barrels, 50 and 25-pound fiber drums, and corrugated cartons.

In 1939, seven plants in the United States produced 768,594 pounds of calcium stearate, valued at $154,406. In 1937, the same number of plants produced 980,101 pounds of the material, valued at $191,839. Calcium stearate is employed as a lubricating agent in the molding of plastics, in drawing wire, in the manufacture of pencils and crayons, in enamels, and in textiles and cement and other compounds as a waterproofing agent.

The price of calcium stearate on June 1, 1942 was 25¢ per pound which price was also in effect on January 1, 1942. On January 1, 1941, however, calcium stearate was quoted at 21¢ per pound.

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Calfskins

CALFSKINS are the skins of young cattle; skins weighing up to 15 lbs. each falling into this commercial classification. The animals are slaughtered when they are a few days to a few weeks old, and the skins are taken off and cured in practically the same manner employed for preparing all types of cattlehides. The skins of unborn or prematurely born calves are known commercially as slunks, while the skins of older calves, which fall between the calfskin and the cattlehide commercial groups are known as kipskins.

The United States tans about one-third of all the calf leather produced in the world, and domestic supplies of calfskins, while substantial, do not nearly meet the requirements of the trade and large quantities are normally imported from other countries. The imports ordinarily come chiefly from veal consuming countries because in those sections the calves are milk fed longer than in countries where the animals are raised largely for dairy products. Milk fed calves have superior skins as a definite change in the hair and skin takes place when the animals begin to eat grass.

Normally the United States tans about 13 million calf and kipskins annually, importing about 25 per cent of the raw stock. Of the imports, about half normally come from Europe. The war has shut off the supply of European skins, but it is estimated that during 1941, the United States imported between three and one-half and four million calfskins. Imports from South America have become increasingly important as a result of war conditions, but South American calfskins are usually extremely heavy or extremely light, and not nearly as well suited for making the types of calf leather usually produced in the United States.

The principal sources of imports during 1941 were New Zealand, Canada, Africa, Uruguay, and Argentina. Many of the recent imports have been of very different types of skins than those previously obtained, and tanners in the United States have been forced to make many readjustments in their tanning methods in order to utilize unfamiliar types of skins as substitutes for those normally imported.

The normal production of calf and kip leathers in the United States (the two are commonly grouped in compiling leather production statistics) amount to roughly 13 million equivalent skins. In 1941, this was increased to an estimated total of some 20 million or more equivalent skins. The raw stock for this high production record was obtained by using the entire domestic production, all available imports, and by drawing on reserve supplies.

It is estimated that domestic production of calf and kipskins in 1942 will be approximately 12 million skins. It is believed that imports will probably not amount to more than three million skins, and this import prediction is highly speculative.

Against a probable domestic production of 12 million skins or less, the Navy is expected to require about a million and a half skins

for footwear, and considerable quantities will be used for some other military purposes. Trade authorities believe that about 10 million skins may be available for civilian uses—only a little more than half the total 1941 production of calf leathers for all purposes.

Government control of calfskins began in June, 1941 when calfskins were included with cattlehides under a price ceiling, which has since been several times revised. The latest revision affecting calfskins was made in Oct., 1941 when various price differentials were established. Ceiling prices prevailing as of July 31, 1942 were 23½ to 27¢ for packer skins; 20½ to 23½¢ for Chicago city skins; and 16 to 18¢ for country skins.

The average price of all types of calfskins in 1940 was 21.90¢ per pound.

Control of the supplies of calfskins was taken by the War Production Board in July, 1941 and no sales or deliveries can now be made without WPB permits, which action establishes a set of preferences to protect supplies needed for military and essential civilian purposes.

Calf leather is popular for shoe uppers as it does not scratch or scuff easily, is porous, and has a grain pattern that is distinctive in character. It is used for men's, women's, and children's dress shoes, handbags, gloves, garments, bookbinding, and some varieties of leather goods.

Among the most common leathers made from calfskins are smooth finished calf, suede finished calf, embossed calf, boarded grain calf, waxed calf, Russia calf, and patent calf.

Calfskins have been tanned into leather since ancient times, and were tanned in the United States since the development of cattle herds here which furnished supplies of raw stock for the tanners. The earliest calf leather tannery of importance was established in the Catskills in New York in 1717.

From ancient times until the 19th century, calf leather was tanned by using various barks, leaves, nuts, etc., but in 1880 a new tanning method was developed in the United States by Augustus Schultz for the tanning of leather by the use of chromium salts and this method, together with a second chrome tanning method developed later by Martin Dennis, is now the most widely used method for tanning calf leather.

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Calomel

See Mercury Chlorides

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Camphor

CAMPHOR or gum camphor is a colorless or white crystalline solid with a characteristic aromatic odor. While commonly thought of as a gum, camphor differs from the usual conception of gums in being crystalline. Chemically it is a ketone. It is only slightly soluble in water, and readily soluble in the organic solvents, such as alcohol, ether, and chloroform.

The principal source of supply of natural camphor is by distillation of the wood of the camphor laurel tree, *Cinnamomum camphora*, which is native to Formosa, Japan, and China. Small scale commercial cultivation of camphor is also now practiced in Florida. Steam distillation is employed to obtain the camphor from the twigs of the tree. The crude material is then fractionally distilled, froze, or chemically treated to separate the camphor oil and gum camphor portions. The crude gum is then purified by subliming it in the presence of quicklime and charcoal. Synthetic camphor, which now satisfies much of the industrial needs in the United States, is prepared from pinene, which in turn is obtained from turpentine.

Imports of natural crude camphor into the United States during 1940 amounted to 712,963 pounds, valued at $237,704. In 1939 imports of such material were 1,156,882

pounds, valued at $323,213. Imports of natural refined camphor during 1940 totaled 397,209 pounds, valued at $249,805; while in 1939, such imports were 818,055 pounds, valued at $329,206. Japan was the chief supplier of both grades of camphor in the years shown. No imports of synthetic camphor were recorded during 1940; but in 1939, 528,030 pounds, valued at $212,963, came in, mostly from Germany. Production data as to the amount of synthetic camphor produced by the two manufacturers of such material in the United States are unavailable.

Commercially, synthetic camphor is available in the form of tablets and as a powder. Natural camphor is offered in tablets, slabs, and in powder form. The synthetic powdered material is packed in 250-pound barrels; in one-pound tins in cases containing 100 pounds; and in one-pound cartons containing ½, 1, and 4-ounce tablets. The natural material is packed in 100-pound cases, made up of either one-pound tins of the powder or tablets of various sizes, or of slabs weighing 2½ pounds.

The chief industrial use of camphor is as a plasticizer in celluloid and other synthetic plastics. Other fields of application include smokeless powder, embalming, moth and insecticidal preparations, and in medicine. The price of natural camphor, in powder or slab form, during the first half of 1942 was $1.60 per pound. Tablets were 10¢ higher in price. At the start of 1941, the natural powder and slabs was 82¢ per pound, with tablets 5¢ higher. The synthetic, technical material on June 1, 1942 was quoted at from 42 to 45¢ per pound; while at the beginning of 1942 and 1941 it was quoted at from 36 to 40¢ per pound. Synthetic U.S.P. material in powder or granular form was usually priced 27 or 28¢ above the technical; and tablet form about 40¢ above the technical price level.

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Camphor Oil

THE camphor oils are produced by distillation of the wood of the camphor tree, Cinnamomum camphora, and subsequent separation of the oils from the solid camphor. The two most important in commercial channels are white camphor oil, having a specific gravity from 0.87 to 0.91, and containing the lowest boiling portions; and sassafrassy camphor oil, which is the portion boiling higher than camphor and containing an appreciable amount of safrol, source of its sassafras-like odor.

White camphor oil is used mainly as a turpentine substitute. Sassafrassy camphor oil is used in medicine and in perfuming such products as soap, polishes, and pharmaceuticals. The sassafrassy oil is also fractionated for it safrol content. In 1940, 1,002,598 pounds of the white oil, valued at $161,883, were imported into the United States. Of this China furnished 569,620 pounds, and Japan 432,930 pounds. In 1939, however, 285,651 pounds, valued at $41,815, were imported. Japan furnished 98% of the total.

Sassafrassy oil imports during 1940 amounted to 73,375 pounds, valued at $23,824. Of this quantity, 71,338 pounds came from Japan, and China furnished the balance. In 1939, 117,577 pounds, valued at $30,298, were imported—all of which originated in Japan.

Both varieties of camphor oil were packed in drums, weighing 400 pounds, and tins of 50 pounds. The price of the white oil on June 1, 1942 was in a nominal position. At the beginning of the year, however, quotations between 42 and 45¢ per pound were the rule. At the beginning of 1941, the price was 22¢ per pound. Sassafrassy oil on June 1, 1942 was priced at 45¢ per pound; at the beginning of 1942 it was 42¢

per pound; while on January 1, 1941, it was 25¢ per pound.

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Canadian Whiskey

See Distilled Spirits

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Cananga Oil

CANANGA OIL is one of the essential oils, yellow in color, obtained by distilling the flowers of Cananga Odorata, which grows in the Philippines, Java, Reunion, and Southern Asia. Cananga oil is the name applied to oil of Javanese origin. A more delicately scented oil from the same variety of flower as produced in the Philippines, Madagascar and Reunion is known as ylang-ylang oil. Manila ylang-ylang is highest in quality, while the bourbon ylang-ylang is intermediate in quality. Odor is the determining factor of the oils, since they find their use in perfumery.

Combined imports of cananga and ylang-ylang oils into the United States in 1940 amounted to 55,342 pounds, valued at $87,688. Of this, France supplied 24,754 pounds; and the Netherland Indies, 19,288 pounds. In 1939 total imports were 72,717 pounds, valued at $92,757; with France shipping 33,165 pounds and the Netherland Indies, 18,394 pounds. In 1939, Madagascar also exported 19,148 pounds of ylang-ylang oil to the United States.

The Java cananga oil is supplied in tins of 50 and 25 pounds. The ylang-ylang oils are packed in bottles containing one pound or one kilo. Cananga oil, on June 1, 1942 was priced at from $17.00 to $18.00 per pound. In January, 1942 the price was $14.00; in the same month of 1941 it was $3.00 per pound. Ylang-ylang oils were in scarce position at the beginning of June, 1942; at the beginning of the year, however, they were priced from $20.00 to $35.00, depending upon variety and quality. In January, 1941, quotations were from $7.00 to $23.00 per pound.

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Candelilla Wax

CANDELILLA WAX is a yellowish-brown, translucent to opaque material which occurs as a coating over the entire surface of the candelilla plant. The plant grows wild in Mexico, particularly over the Northern portion of the country. The wax is separated from the plant by immersing the parts in heated water, then dipping off the wax which floats to the surface. It may be refined by treatment with sulfuric acid or sodium acid sulfate (nitercake). It can be bleached perfectly white. Monterrey is a production center.

Candelilla is considered a moderately hard wax, having a melting point in the neighborhood of 68° C. In recent years it has enjoyed a growth in use as a substitute for carnauba wax, being less expensive. Imports of candelilla wax into the United States during 1939 amounted to 3,357,066 pounds, valued at $420,370. In 1940, imports totaled 5,644,136 pounds, valued at $770,397. All originated in Mexico during both years shown.

The uses to which candelilla wax are put are much the same as carnauba (q.v.). Its lower melting point make it slightly inferior in many such applications. The price of candelilla wax, packed in bags, on June 1, 1942 was 38¢ per pound. On January 1, 1942, the material was quoted at 33¢ per pound; while on the first of 1941, the price was 19¢ per pound.

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Capeskin

See Sheepskins

Capsicum

CAPSICUMS are red peppers, cultivated throughout the world, except in the polar regions. They are used principally as a condiment, but also have their uses in medicines. They are usually marketed in bags of varying weight. Prices in April, 1942, ranged from 14¢ to 27¢ per popnd. Two principal grades are "South Carolina Longs" and "Small Africans." There is a 5¢ per pound U. S. duty on imported "foreign" peppers.

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Caraway Oil

CARAWAY, or caraway-seed oil is a colorless to yellow thin oil obtained by the distillation of the seeds of Carum carvi. The caraway plant is cultivated in many parts of the world, particularly in Holland, Scandinavia, France, Russia, Prussia and Asia. The best seed is obtained in Holland. Cultivation of caraway is being encouraged in the United States as a part of the chemurgic program to make this country more self-sufficient. The oil is official in the National Formulary.

In 1940, 17,505 pounds of caraway oil, valued at $37,527, were imported into the United States. The Union of Socialistic Soviet Republics furnished 9,250 pounds of this amount; the Netherlands 4,215 pounds; and France, 2,266 pounds. In 1939, 20,318 pounds of the oil, valued at $31,223, were imported. In that year the Netherlands exported 18,529 pounds to this country; U.S.S.R., 1,102 pounds; and France, 669 pounds. Tin containers holding 25 pounds of the oil are the usual commercial package.

Caraway seeds are well-known to the public through their use in bread, cheese, and other food products. The oil is used in medicine for its carminitive action, and in the manufacture of perfumes, soaps, liqueurs, and gin. On June 1, 1942, the price of caraway-seed oil was $17.00 per pound. In January, 1942, the price of caraway-seed oil was $15.00, and in January, 1941, it was $6.00.

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Caraway Seed

THE fruit or seed of a plant cultivated throughout the northern and central parts of Europe and Asia. There is practically no Caraway grown in the United States, although it is found in a naturalized state from Newfoundland to Colorado. Most of our imports have come from Holland, Russia, Poland, Syria and Morocco, in the past. The seeds when bruised have an aromatic odor and a spicy taste. They yield a volatile oil, the chief constituent of which is cymene aldehyde, which is processed by steam distillation. While the oil finds its principal use for pharmaceutical purposes and as a flavoring agent in cooking and in liqueurs, the seed is used chiefly in flavoring baked products, bread, etc. It is marketed usually in bags and is non-perishable. Principal types are: "Recleaned" and "Dewhiskered." Decorticated dill is rated a "very poor substitute" by important trade sources. There is no duty imposed on foreign imports.

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Carbolic Acid

See Phenol

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Carbon Black

CARBON BLACK is an intensely black pigment produced by burning natural gas in luminous flames which impinge on moving steel channels. The carbon results from the incomplete combustion of the gas.

The carbon black industry has reflected the demands made by the war; production and sales reached an all time peak in 1941. Production, in 1941, was 594,065,000 pounds, or 4 percent over 1940 while sales were

644,744,000 pounds, or 22 percent above the 1940 figure. There were 365,377 million cubic feet of gas burned in the manufacture of carbon black in 1941, the average yield increasing from 1.54 pounds per 1,000 cubic feet in 1940 to 1.63 pounds in 1941. This gain was largely due to an increase in furnace blacks, which have a relatively high average yield.

About 80 percent of the U. S. production is produced in the State of Texas, the balance in Louisiana and Oklahoma. The United States produces practically all the world's carbon black, Rumania and Japan together having an estimated output of not more than 5 million pounds.

The rubber industry normally consumes about 85 percent of the carbon black supply for toughening the treads of tires and reinforcing rubber compounds. About 6 percent goes into black printing inks, 3 to 4 percent into paints and varnishes, and the balance into miscellaneous products.

Carbon black was priced in mid-1942 at 3.55¢ per pound, bags, carloads, F.O.B. Texas. The price in hopper cars, from the same shipping point was 3.3¢. Shipments are made in less than carload, carload and tank car lots—packed in paper bags, or shipped in bulk in gondola hopper cars in small pellets to facilitate handling in conveying systems.

The grade for the rubber industry is at the standard price with differentials according to the mode of packing but a large number of color grades used in paints and printing ink command a higher price.

There is no known substitute for this material in its present application.

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Carbon Tetrachloride

CARBON TETRACHLORIDE is also known as tetrachlormethane, and occasionally as perchlormethane. It is a colorless liquid, miscible with the organic solvents, such as alcohol, ether, chloroform, and benzene, and with most of the fixed and volatile oils. It is very slightly soluble in water. Carbon tetrachloride is manufactured by reacting chlorine with carbon bisulfide in the presence of antimony pentasulfide, which latter compound acts as catalyst. Iodine is also sometimes used as the catalytic agent. It is purified by washing with a caustic soda solution to remove sulfur chloride, and then rectifying.

Carbon tetrachloride is well known as a fire extinguishing fluid. It acts in this manner because its heavy, non-inflammable vapors displace the air surrounding the burning material and thus snuffs out the blaze. It is also an important oil and fat solvent and finds considerable use as a dry-cleaning, agent, particularly in the home. In commercial dry-cleaning a corrosion inhibitor is combined with the carbon tetrachloride, since it has been found to react slowly with any water present to form hydrochloric acid, or muriatic acid, which attacks the metal of the processing equipment. The solvent properties of carbon tetrachloride also are responsible for its use in numerous products and industrial procedures.

Production of carbon tetrachloride in the United States during 1940 amounted to 100,811,330 pounds. Sales of the material in that year were 79,674,547 pounds, valued at $3,093,415. Commercially, technical, chemically pure, and medicinal grades of carbon tetrachloride are offered, and shipment may be arranged in containers ranging in size from a one-pound bottle to a tankcar. Most popular of the commercial packages is a drum containing 52½ gallons, and small drums containing 5 and 10 gallons. Usual commercial specifications for carbon tetrachloride call for a purity of 99.99 percent, practically complete volatility, no residual odor, and a boiling range within 1° C.

The price of carbon tetrachloride on June

1 and January 1, 1942 was 73¢ per gallon. At the beginning of 1941 the price was 66¢ per gallon.

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Silicon Carbide (Carborundum)

"CARBORUNDUM" is a manufactured abrasive, approaching the diamond in hardness. Upwards of 40,000 tons are produced annually in the United States in resistance type electric furnaces, using two principal crude materials, sand and coke. It is used for abrasive and refractory purposes—such as grinding wheels, polishing grains, coated abrasives, super refractory products, etc. It is marketed in the grain form by the carload, pound or lot, ranging in price—depending on quality—from 16¢ to 20¢ per pound. Principal types of grain are: crude, graded grains, and powders and flours. Other abrasives can naturally be used as substitutes.

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Cardamom Oil

CARDAMOM, or cardamomseed oil is a pale yellow oil obtained by distilling the seeds of Elettoria Cardamomum, which is indigenous to the southern coast of India, Ceylon and Siam. The oil is official in the National Formulary. Commercially the oil is packaged in one-pound bottles since it is one of the more expensive essential oils. It is used in medicine, in making liquers, and as an ingredient of certain perfume combinations. On June 1, 1942, cardamon oil was priced at $25.00 per pound. At the beginning of the year it was $30.00 per pound. A year before, in January, 1941, its price was $16.00 per pound.

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Carmel Malt

See Beer

Carnauba Wax

CARNAUBA WAX is also known as Brazil wax, and occurs in the market as hard, amorphous lumps, varying from light yellow to greenish brown in color. It is obtained as an exudation from the leaves and eyes of the Brazilian wax palm, *Copernica cerifera,* particularly in the northern sections of the country. In volume, carnauba is the most important vegetable wax imported into the United States. Brazil is the principal producer; cultivation of the carnauba palm has been attempted in other parts of the world, particularly Ceylon, but have met with but little success.

The carnauba palms grow wild in northern sections of Brazil and it is estimated that the states of Ceara and Piauhy produce approximately 80 percent of the annual wax output. The wax forms on the trees in dry sections as a natural protective covering against moisture evaporation. In harvesting the wax, the leaves and eyes of the trees are cut off with a pruning knife attached to a long pole, dried for several days, following which the wax is removed by various methods. Beating, or whipping is one of the more common means of removing the wax, with the wax being collected as dust and small particles in a sheet, from which it is transferred to pots containing boiling water or heated alone. The molten wax is dipped from the surface of the water or run into molds to cool in cakes.

The grades of carnauba encountered in commerce are identified as Number 1, 2, and 3 Yellow or Refined; North Country and Chalky. The chalky grade, so-called because of its physical appearance, is the cheapest grade, containing dirt as an impurity. North Country is also a crude grade, generally of slightly better quality than the chalky. The yellow grades are refined to various degrees, with the Number 1 grade being the best. Commercially, carnauba wax is packed in bags and cases. Imports of the wax into the

United States during 1939 amounted to 16,358,508 pounds, valued at $4,928,147. Of the total, 16,351,788 pounds came from Brazil. During 1940, imports totaled 16,925,931 pounds, valued at $7,808,283.

Carnauba is the hardest vegetable wax commercially available, and has a melting point of about 85° C. Its property of taking a high polish when rubbed with a soft material, and not "fingermarking" at normal temperatures has especially adapted it to use in polishes of all kinds, which constitute the largest field of application. Other uses include: as an ingredient of insulating compositions, phonograph records, candles, leather finishes, and carbon paper coatings. The approximate price of the low-grade, chalky carnauba wax on June 1, 1942 was 77¢ per pound. Number 1 yellow at the same time was 88¢ per pound. On January 1, 1942, prices were approximately one cent lower; while on January 1, 1941 a comparable grade of chalky was quoted at 57¢ per pound, and the number 1 yellow at 69¢ per pound.

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Carnotite

A MINERAL found in Utah and Colorado and a source of radium, uranium and vanadium. It is a vanadite of uranium and potassium; found with other sands, imparting to them a pale, yellow color. The ores may contain from 2 to 5 percent uranium oxide and up to 6 percent of vanadium oxide, but usually run 2 per cent V_2O_5. In processing for vanadium oxide, the ore is roasted with salt, water leached, and the oxide precipitated with sulphuric acid. This so called "red cake" is then fused in a reverberatory furnace and either cast as pigs of approximately 100 lbs. each or as thin scale which is sacked for shipment. The production of radium from the ore is a tremendous undertaking. It is estimated that over 400 tons of carnotite sand are required for the production of but one gram of radium. (See Vanadium, Radium.)

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Carpincho Skins

See Pigskins

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Casein

CASEIN is a white amorphous phosphoprotein occurring in the milk of various animals. It is precipitated by acids. Lactic acid casein is used in coating papers, in making coldwater paints and glue, and in printing wallpaper and fabrics. Rennet casein is used chemically in the manufacture of plastics. Casein is powdery in appearance.

The quantity of edible casein produced is very small.

Commercial production for the American market is now limited to the Argentine and domestic product, French casein being off the market due to the war. Casein is sold only in bags.

Casein is graded by its coarseness, the most commonly-used grade being the 20-30 mesh. Official production figures are not available for the reason that there are so few domestic producers that compilation of data is not feasible without revealing production totals of individual companies. Reliable trade estimates, however, place domestic production for 1941 at 35,000,000 pounds, which was 5,000,000 pounds below the 1940 estimate.

The unit of purchase from the processor is the ton with the market quoted on the pound basis. July, 1942, quotations in the New York market were 17 to 18 cents per pound for 20-30 mesh Argentine powdered casein and 16 to 16½ cents per pound for the domestic 20-30 mesh product. These prices were sharply under the peak of 30 cents a pound reached in 1941, and reflected

to a great extent a sharp drop in the use of casein by the paper-coating industry, normally the largest users under normal conditions.

Casein is affected by moisture and must be kept in dry storage, with the average life of the product under proper storage three to nine months, depending upon grade.

Because of its cheapness, there is no acceptable substitute for casein in commercial use. Chemical resins, much more expensive, can be used in place of casein for many purposes, however.

The import duty is $2\frac{3}{4}$ cents per pound.

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Casein

See Plastics

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Cashew Nuts

THE cashew nut is the fruit of the cashew tree, natural to warm climates in many parts of the world. Supplies for the American market, however, come almost entirely from India.

Cashew nuts are marketed almost exclusively in shelled form and are mostly imported in this form. They have been in increasing use in recent years, being the cheapest nut available, with the possible exception of peanuts. They are used commercially largely in the confectionery and baking trades, and to a limited extent in ice cream manufacture, and are popular in the consumer market in shelled and roasted form. The roasted nut in appearance resembles the peanut as to color, but is somewhat crescent-shaped.

Commercially, shelled cashews are marketed as to size and grades, the size range being as follows: 200/210 count (to the pound) whole, 220/240s, 260/280s, 300/320s, 375/400s, and 400/450s, and in the broken grade, designations are: — Fancy butts, fancy splits, fancy pieces, and slightly scorched pieces.

Data on annual production are not available, but supplies continue to come forward, notwithstanding hostilities in the area surrounding India.

The unit of purchase is the pound, and the nuts are purchased raw by importers and roasted here. The shipment unit is two 25-pound tins to the case. When roasted, the same unit type of packing prevails for the commercial trade, with a wide variety of sizes, from 2-ounces up, for consumer packaging.

Cashew nuts require cool storage to prevent weevil infestation and quality deterioration.

Trade quotations in July, 1942, were: Whole, 200/210 count, $46\frac{1}{2}$ cents per pound; 220/240, 45 cents; 260/280, 44 cents; 300/320, 43 cents; 375/400, 42 cents; 400/450 count, 41 cents; fancy butts, 38 cents; fancy splits, 37 cents; fancy pieces, 39 cents; slightly scorched pieces, 29 cents.

Cashews can be shipped safely either rail or by truck, or by water.

As to substitutes, cashews and peanuts are interchangeable with some commercial users.

The import duty on cashews is 2 cents per pound.

Cashew Nuts come under the General Maximum Price Regulation.

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Cassava

See Tapioca

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Cassia Oil

CASSIA OIL is a yellow to brown oil obtained by the distillation of the twigs and leaves of Cinnamomum cassia. It is sometimes called Chinese cinnamon oil, since

its odor resembles true cinnamon oil. The United States Pharmacopeia accepts it as a substitute for cinnamon oil.

Imports of cassia oil into the United States during 1940 totaled 283,513 pounds, valued at $227,744. Of this amount China furnished 283,500 pounds. In 1939, imports were 215,338 pounds, valued at $127,711. China supplied 215,105 pounds in that year. In commerce, technical cassia oils are available in grades varying from 75 to 85% in cinnamic aldeyde content, packed in drums weighing approximately 420 pounds. A redistilled U.S.P. grade is packed in drums of 500 pounds and tins of 50 pounds. All cassia oil must be redistilled before use since the cinnamic aldehyde attacks lead, which may form a portion of the container in which it is originally packed. Redistillation removes any lead content.

Cassia oil is used in flavoring and in perfumery. On June 1, 1942 the price ot U.S.P. cassia oil was $10.00 per pound, which price was also in effect at the beginning of the year. In January, 1941, the oil sold for $1.50 per pound.

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Cast Phenolic Resins

See Plastics

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Castor Oil

CASTOR OIL is derived from the seed beans of the castor plant, which is a native of most tropical and sub-tropical countries. It grows wild and is also cultivated extensively. Imports into this country are primarily in bean form, coming mainly from South America and India. United States oil production from imported plus a small quantity of domestic seed approximated 100 million pounds in 1940.

Castor beans contain approximately 50 per cent of oil. Most of the oil derived from the first cold pressing is used for industrial purposes. The lower grades obtained from subsequent hot pressings are used for commercial lubricating purposes. The remaining cake is used for a fertilizer and is poisonous. Pure castor oil is colorless and has an unpleasant taste. It has an iodine value of from 82 to 90 and a saponification value of 178-182. Castor oil is soluble in alcohol.

Castor oil falls into the category of a non-drying oil but, by means of a catalytic treatment, a drying oil is now being obtained by splitting off water. During 1940 about 25 million pounds of castor oil were consumed in the drying industries. .It has many other industrial uses, among them being waterproofing of leather and as a filler to leather, giving it more elasticity and permanency. It is mixed with other oils for cutting compounds. It can also be converted into blown oils. The use of castor oil for medicinal purposes is well known. It is used as an active cathartic. Externally, it is used in hair tonics and as a demulcent in eye burns.

The price of castor oil in New York (No. 3, bbl.) averaged 13.8 cents per pound during May, 1942. The price of castor oil, dehydrated, drums, carlots was 18.6 cents.

The duty on castor beans is ¼ cent per pound from Brazil and British India. The duty on castor oil is 3 cents per pound.

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Cateceum

See Spermaceti

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Catechu

THE name given to a number of extracts from the Far East used in the tanning and dyeing industry but, specifically, an extract from the heartwood of the acacia catechu, or acacia sundra sometimes called Ben-

gal catechu, or acacia catechu. Colors are either black, dark, or brown catechu.

It is also called "cutch," and is used in tanning leather and in dyeing where it imparts a brown color. Like other vegetable tannins of the catechol group, it contains catechu tannin $C_{15}H_9$ $(CH)_5$.

It is obtained by decoction or evaporation from the plants (in general, from the wood, leaves, or fruits). It is marketed either as a liquid—a water solution containing about 25 percent tannin, or as a solid which contains about 50 percent tannin. It is extremely astringent.

The appellation, catechu, is also given to the chocolate or reddish brown extract of the betal nut, and the extract of the mangrove (bark), while a so-called new cutch is a tannic-acid extract from European conifers.

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Cattle

For thousands of years, cattle have constituted one of the major sources of food for man.

While cattle are distributed throughout the world they are chiefly concentrated in four areas: Europe, India, the River Plata area of South America, and the United States. It is currently estimated that India leads in cattle numbers with about 210 million; but this estimate includes buffaloes. The United States is second with approximately 74.6 million head. Russia, Brazil, and Argentina also have large cattle populations.

Four great areas of beef cattle production are recognized in the United States. They are: (1) the Range Regions, including all of the territory west of a line roughly through the central Dakotas, the western part of Nebraska, Kansas, part of Oklahoma and West Texas; (2) the Cotton Belt, including the eastern part of Texas, the Gulf States, Georgia, South and North Carolina; (3) the Appalachian and Great Lakes, including the remainder of the east coast states west to Central Ohio and Michigan, Wisconsin and the eastern part of North Dakota, and a corner of South Dakota and (4) the Corn Belt and adjacent area, including the great feeding area of Iowa, Illinois, Indiana, part of Ohio, a part of Kentucky and Tennessee, all of Missouri and part of the states of South Dakota, Nebraska and Kansas.

In recent years cattle feeding has been shifting somewhat to the Cotton Belt and Gulf Coast areas, due to the increased production of feedstuffs in that territory. However, the importance of beef cattle in agriculture rests chiefly upon their ability to convert coarse forage and grasses, as well as corn, cottonseed and other concentrates into a valuable and much desired food. Cattle, like sheep, are well adapted to rough land and sparse grazing. Although beef is the chief human food, produced on about three-fourths of the total land area of the United States, the Great Plains region is well known as the cattle producing area of the country.

Dairy cattle are becoming more widely distributed as the increased and improved facilities for transportation have developed. The milk sheds of large cities continue to claim the largest concentration of dairy production in easy hauling distance of the great metropolitan centers. Although dairy animals and veal calves from dairy herds enter into our meat supply, the range producer is the source of feeding animals which are produced and delivered to Corn Belt feed lots for finishing ultimately into quality beef.

Because of the distinct separation of the cattle producing and cattle feeding area there is a continuous problem involved in the marketing and distribution of feeder cattle. In this movement from the grower to the feeder ownership may change hands one to several times, involving in each transaction a mutual agreement between buyer and seller. This constitutes a marketing

problem which has been the subject of extended study and experimentation by beef growers and feeders in an effort to find ways and means of making the exchange at the least cost to both. The western producer or stockman is definitely concerned with range, temperature, rainfall and supply of native grasses. With cattle grazing in the summer on the range and in the national forest he meets his first problem. The next is to find a feeder who will take his unfinished animals and fatten them to the proper degree of finish to meet the demand for quality beef. Good crops in the Corn Belt are quite as much the concern of the western range producer with his wide, sparsely producing areas as are the conditions at home during the grazing season. Invariably large crops of corn in the feeding area sends many buyers to the range country who bid against each other for feeding cattle to consume their abundant grain and forage crops.

The cattle population on January 1, 1942, was estimated at about 74.6 million head. This constituted an all-time high, exceeding the previous record (1934) of 74.3 million head. The national production goal for 1942, as set forth by the Department of Agriculture, called for a slaughter of 28 million cattle and calves compared with 25.9 million head in 1941. Cattle are raised primarily for their meat and dairy products.

Cattle are sold by the hundredweight. The price of beef steers (choice and prime) at Chicago averaged $14.71 per hundred pounds in March, 1942. Transportation is largely by rail.

Grades of beef steers include choice and prime, good, medium and common.

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Cattlehides

CATTLEHIDES, strictly speaking, are the hides and skins of bovine animals of all ages. Commercially, however, cattlehides are sub-divided into three major groups: steer, cow, and bull hides; kipskins; and calfskins. From these three groups of hides and skins are made many of the most important leathers in common use. It is estimated that about 90 percent of all cattlehide leathers (including those made from kipskins and calfskins) is used for shoe upper and sole leather, the remainder being used for manufacturing belting, harness, luggage, upholstery, and other products.

The division of cattlehides which bears commercially the proper name of the entire group of bovine hides and skins consists only of the hides of steers, cows, and bulls; kipskins and calfskins being separately classified in trade.

Cattlehides are a by-product of the meat industry, and their production is regulated entirely by the production of meat. They are produced in sizeable quantities throughout the world, but the quality and commercial value of the hides produced in different countries and districts vary greatly.

Numerically, India is the world's largest producer of cattlehides, having the largest herds of meat cattle in the world (about 25 percent of the total). The commercial value of cattlehides from India ranks well below that of the hides produced in many other countries, however, as the average weight of mature cattlehides of the country is only about 15 pounds dry. The hides which enter world commerce from India average about nine pounds each and only a few are as heavy as 15 pounds.

The second largest producer by quantity, and the first by commercial value, is the United States, where improved methods of breeding and raising cattle, slaughter for meat, and take-off of hides have raised the commercial value of the country's entire cattlehide production far above the average prevailing in other countries. Cattlehide production in Canada is far below that of the United States in quantity, but compares

closely in quality and commercial value. Domestic cattlehides are commercially classified according to manner of take-off, whether produced by regular meat packers or country butchers, point of take-off, weight, grade, season of take-off, etc.

Most Mexican cattlehides are sold without weight classification and the quality of take-off varies greatly according to the section of production. Cuba produces fairly heavy hides of fair quality, as do several Central American countries. Peru and Bolivia produce relatively few hides of uncertain quality. The take-off and cure of hides in Chile are of very good quality.

The River Plate district of Argentina and Brazil is the world's third largest cattlehide production district and is second only to the United States in the production of heavy hides. Hides from the River Plata district are classified according to type of take-off, etc., and are generally of very high quality.

Russia ranks fourth in cattlehide production, a substantial proportion of the production being consumed by tanners within the country and only a small part being exported, usually in exchange for heavy sides which are not produced in Russia. The quality and take-off of Russian hides is usually only mediocre to fair.

Northern Africa produces large quantities of medium and light weight cattlehides, and Southern Africa produces substantial quantities of heavier hides. The sizeable quantities of cattlehides produced in other countries range in quality from inferior to very good, but most of these hides are consumed locally and they are unimportant in world trade.

Domestic cattlehides are usually "cured" at the point of take-off, immediately after flaying, to retard bacterial action and putrefaction. The most common method of curing hides in the United States and many other countries is known as green salting. As soon as the hides are removed from the carcass they are cleaned as much as possible of dirt and blood, bits of flesh are removed by scraping, ragged edges are trimmed, and the ears are removed. The hides are then placed in a cool place for an hour to remove the animal heat, after which they are laid, hair down, on the floor, and sprinkled with fresh, clean salt. They are then piled into a "pack" which is allowed to cure for 30 days or more, and is then "taken up." The hides are removed from the pack, swept free of salt, classified, and graded for sale.

Argentine meat packers cure hides by a brining process, in which the hides are soaked for 48 hours in a brine pickle before being drained and salted down in much the same manner as the green salted method. Other methods of curing are used chiefly for goat, kid, and similar light skins and some are employed only by primitive natives of some sections of the world.

The common grades of domestic packer cattlehides are as follows:

Native steers (free of brands): — Unbranded steer hides; heavy, light, and extra light weights.

Butt branded steers:—Butt branded steer hides; heavy and light weights.

Colorado or side branded steers: — Side branded steer hides; heavy and light weights.

Heavy Texas steers:—Side branded steer hides of narrow, close compact pattern, and plump. Heavy weight.

Light Texas steers:—Same as heavy Texas steers, but light weight.

Extra light Texas steers:—Same as heavy Texas steers, but extra light weight.

Heavy native cows (free of brands):—Unbranded cowhides; heavy weight.

Light native cows (free of brands):—Unbranded cowhides; light weight.

Branded cows: — Branded cowhides; all weights; may include extra light branded steers.

Native bulls—Bull or stag hides which are free of brands, regardless of weight.

Branded bulls — Any bull or stag hides which are branded on any part of the hide.

Domestic hides and skins are roughly classified into two major groups according to their origin: Packer hides and skins and country hides and skins.

Packer hides and skins are those which are taken off and cured by meat packing plants in the United States and Canada. These are commonly known in the trade as big packer hides and skins, those produced by the four biggest meat packing concerns in the country; independent packer hides and skins, those produced by large meat packing companies not included in the "Big Four"; and small packer hides and skins, which are produced by the smaller packing concerns.

Country hides and skins are those which are taken off by butchers and farmers in scattered sections and collected in either a green (uncured) or a salted state by collectors and dealers.

Because of the high degree of specialization in the operations of the meat packing plants, the hides and skins produced in these plants are much more uniform in quality of take-off and make better grades of leather than do country hides and skins which are frequently taken off by unskilled methods from animals of varying quality and are often damaged in numerous ways.

Packer hides and skins command a better market price than do country hides and skins.

Cattlehides are sold on a per pound basis and ceiling prices were established by the Office of Price Administration in June, 1941 on all types of cattlehides.

Several amendments have been issued to the original price ceiling order. The original ceiling was a simple one, setting a flat price of 15 cents per pound on all cattlehides. The operation of this type of a schedule was found to be unpractical and an amendment issued in Sept., 1941 established differentials for different qualities of hides. In Oct., 1941, another amendment was issued, requiring that all sales of cattlehides be made on an f.o.b. shipping point basis. Prior to this, some hides and skins had been selling on a delivered basis and others on a shipping point basis.

Ceiling prices on the above grades of cattlehides in effect in July 31, 1942 were as follows:

Native steers—15½¢.
Butt-branded steers—14½¢.
Colorado steers—14¢.
Heavy Texas Steers—14½¢.
Extra light Texas steers—15¢.
Heavy native cows—15½¢.
Light native cows—15½¢.
Branded cows—14½¢.
Native bulls—12¢.
Branded bulls—11¢.

These ceiling prices compare with average monthly prices during 1941 as follows:

Native steers—12.54¢.
Butt-branded steers—11.90¢.
Colorado steers—11.45¢.
Heavy Texas steers—11.91¢.
Light Texas steers—11.27¢.
Extra light Texas steers—12.02¢.
Heavy native cows—12.38¢.
Light native cows—12.71¢.
Branded cows—11.78¢.
Native bulls—8.89¢.
Branded bulls—7.89¢.

An important restriction was placed by the Government on the marketing of cattlehides when the War Production Board, in July, 1941, froze the entire supply of hides in the United States. In order for tanners to secure hides with which to make leather, it is now necessary for them to obtain permits from the WPB each month. This move was taken to protect the nation's supply and production of hides suitable for making military leathers and to allocate the hide supply for military and essential civilian uses in preference to non-essential civilian uses.

As has been pointed out, cattlehides are used for making some of the most important

types of leather, chief of which are shoe upper and sole leathers. Cattle were reportedly introduced in North America by Christopher Columbus who, on his second voyage in 1493, brought with him a small herd. Later herds were introduced in various parts of the Continent in following years, but it was not until about 1650 that cattle stocks in Virginia and New England increased to such a size that domestic raw stock for making cattlehide leather in scattered tanneries began to replace imported hides to an appreciable extent.

Practically all shoe sole leather (excluding light leather used for soles of slippers, etc., and not commercially termed sole leather) is made from heavy cattlehides. Sole leather is cut from all parts of the hide and is graded for quality according to the part of the hide from which it is taken, its tannage and fibre, its color and texture, and the smoothness of its grain. Ordinarily, outsoles are cut from the back or bend portions of a hide; insoles from the bellies and shoulders; and other shoe parts such as welting, counters, box toes, heel lifts, etc., from shoulders, sides, and other light parts of the hide.

Cattlehide shoe upper leather is made from the sides of light weight cattlehides, from kip sides, and from whole kipskins and calfskins. In general trade practice cattlehides are split along the backbone into two halves, or sides, from which "side upper leather" is made. Large kipskins are also so split, to make "kip side leathers," the difference between the two being one of size and weight and fineness of grain—the kip sides being the smaller, lighter, and finer grained. Whole kipskins and calfskins are tanned to make commercial kip and calf leathers, the kipskins being larger, heavier, and coarser grained than the calfskins.

Side upper leather is usually shaved over the entire flesh side to make it uniformly thick. It is finished in a variety of ways and is used for making patent leather, commercial elk leather, Army shoe leather, work and sport shoe leather, simulated buckskin leather, suede leather, and a number of special leathers.

The importance of cattlehide upper leathers for military as well as civilian uses is indicated by trade estimates that an estimated 4,200,000 cattle hides will be required annually to make upper leather for Army service shoes and an estimated three million cattlehides for Army sole leather. Civilian requirements are estimated to bring the demand for cattlehides to a total consumption level of about 28½ million hides annually on the basis of leather demand in 1940 and 1941.

It is estimated that 1942 production of cattlehide leathers from both domestic and imported raw stock will be about 32 million equivalent hides, leaving a shortage of over six million hides, to be met by the use of other types of leather or by allocating available cattlehide leather supplies, with non-essential civilian requirements at the bottom of a list headed by military needs.

It is believed by the trade that a substantial reduction in shoe production will be necessitated by the cattlehide situation, and shoe manufacturers are experimenting with various substitutes for sole leather, with wood and composition soles now apparently providing the greatest promise of success in this direction. Rubber soles are out of the picture and although experiments have been made with several types of plastics for this purpose, these plastics are made from vital war materials and cannot be procured in any satisfactory quantities as a substitute for sole leather.

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Caustic Soda

CAUSTIC SODA is also known as sodium hydrate and sodium hydroxide when in its solid, white form, and as lye or soda lye when dissolved in water. It is very soluble in water, solutions containing 50 percent of the material being possible. Both forms must

be handled cautiously, since the caustic destroys organic material.

One of the methods by which caustic soda is manufactured is by the electrolysis of a saturated solution of common salt. The electric current dissociates the salt, the sodium ions migrate to the cathode, or negative side of the electrolytic cell, are reduced to metallic sodium, which immediately reacts with the water present to form hydrogen and sodium hydroxide. The gaseous hydrogen is collected and the sodium hydroxide remains in the cell solution. The chloride ions of the salt meanwhile migrate to the anode, or positive side, of the cell, lose their electrical charge and form chlorine gas, which is collected. When practically all of the salt has been broken up, the cell solution is heated to drive off the water and the sodium hydroxide obtained in solid form.

The hydrogen and chlorine formed by the cell are sometimes reacted to produce hydrochloric, or muriatic acid, but more often sold as such. Chlorine and caustic soda production are therefore closely related, and consumption must be balanced to prevent piling up of one or the other, with a possible demoralizing on the market of the materials.

Caustic soda is also manufactured from sodium compounds, particularly soda ash, by what is known as the lime-soda process or ammonia process. Slaked lime, or milk of lime, is added to the sodium salt, producing a solution of caustic soda and slowly precipitating out calcium carbonate. After precipitation is complete, or practically so, the soda solution is drawn off and evaporated to the concentration desired.

Several systems for expressing the alkalinity of caustic soda have been or are used in commercial practice. The earliest system, the "Newcastle test," was based on the sodium oxide content and has been found to be somewhat erroneous in comparison with the sodium oxide evaluations now accepted. There followed the "New York and Liverpool test" which was also found to be inexact, over-rating the sodium oxide content of the caustic. The German degree system again is based on the alkali content expressed in sodium carbonate equivalents, and the French degree method indicates the alkaline content in terms of the sulphuric acid chemical equivalency. In illustration, the grade at present calculated to contain 76 percent of actual alkali (sodium oxide), under the Newcastle test was evaluated at 77.00 percent sodium oxide; under the New York and Liverpool test at 78.45 percent sodium oxide; under the German system as 129.94 percent sodium carbonate; and under the French system as 120.13 percent sulphuric acid. The actual caustic (sodium hydroxide) content of this grade under present day evaluations is 98.06 percent.

The production of caustic soda for sale during 1939 amounted to 950,157 tons, valued at $34,541,479. Of this quantity, 523,907 pounds, valued at $19,446,529, were produced by the limesoda process and the remainder by the electrolytic method. In 1937 the total output was 897,411 tons, valued $32,027,796, with the lime-soda process accounting for 481,934 tons, valued at $17,890,626.

The most common commercial grade of caustic soda is identified as 76 percent sodium oxide content, and is offered in flake, powder, and solid form. A 60 percent material is also sometimes encountered. Caustic soda is also offered in concentrated solution form, containing either 47 to 49 percent or 70 percent of sodium hydroxide. The solid forms of material are shipped in 55, 100, and 400 pound drums. The liquid is in 110 gallon drums and 8,000 gallon tankcars.

The manufacture of rayon is the largest single consuming field for caustic soda, although it is estimated that the manufacture of soaps and cleaning compounds consume an even larger tonnage. Other major users are the chemical industry, petroleum refining, pulp and paper making, and textile process-

the material being possible. Both forms must ing. It is also consumed by the rubber reclaiming and vegetable oil refining industries, and large amounts are exported. The price of powdered or flake, 76 percent caustic soda has been quoted at $2.70 per 100 pounds, at the works, in recent years. The solid 76 percent material has been $2.30 per 100 pounds.

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Cayenne Pepper

A PREPARATION made from the various species of capsicum or red pepper plant. It is produced by drying and grinding the ripe pods. The plant is commonly cultivated in the East Indies and produced also in Central and South America, where it is believed to have originated. In the United States, production takes place in South Louisiana and South Carolina. Output is estimated at 800,000 to 1,000,000 lbs. dried. It is used primarily as a seasoning for foods. "Cayenne pepper" in the food trade has a more limited definition, being "a ground preparation made from dried cayenne pepper." The "Cayene" in this instance refers to a specific variety—long, slender, crooked shape hot pepper—excluding, for instance, ground Louisiana sport peppers. The entire pepper in its ripe undried state is used in making pepper sauce.

The marketing unit is the pound. Early in 1942, the price was 15¢ a lb. dried and 5½¢ a lb. pickled. The 1941 price was 11½¢ a lb. dried and 5¢ a lb. pickled. It is transported in bags by trucks. Cayenne pepper can keep for a year in dried form and 3 or 4 years pickled. There is only one grade.

The only substitutes are other varieties of pepper. The rate of duty is 8¢ a lb. and 5¢ a lb. unground.

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Cedarwood Oil

CEDARWOOD OIL is a colorless, pale yellow, or greenish-yellow oil obtained by distillation from varieties of cedarwood, (Juniperus virginiana) and of the by-product wood shavings in pencil manufacturing. The by-product material has a slightly lower specific gravity than the other. American production of this oil is centered in the Southern states, particularly Tennessee; and in the Northwestern states, particularly Oregon. England and Germany produce comparatively small quantities.

The American cedarwood oils are packed in drums of about 400 pounds and in 50-pound tins. A special grade for use as a microscopic clearing and immersion oil is packaged in 25-pound tins. The regular grade of cedarwood oil, because of its cheapness, finds extensive use as a soap perfuming agent and as an industrial odorant. It is also used in insectifuge compositions and in medicine. Southern cedarwood oil, during the months of 1942 until June was priced at about 80¢ per pound. On January 1, 1941, its price was 25¢ per pound.

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Celery Oil

CELERY, or celery seed oil is produced by distilling the ripe seeds of the cultivated variety of Apium Graveolens. France is the principal producing country. It is a pale yellow or greenish-yellow in color. Commercially it is packaged in small containers, usually one-pound tins or bottles, since it is rather expensive. Its chief use is as a flavoring material; some is also employed in certain perfume combinations to impart a fresh note.

In the first five months of 1942, the price of celery seed oil was approximately $30.00

per pound. On January 1, 1941, the price was $15.00 per pound.

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Celestite

See Strontium

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Cellulose Acetate

See Plastics

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Cellulose Acetate Butyrate

See Plastics

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Cellulose Nitrate

See Plastics

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Cement

See Portland Cement

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Ceramic Glazes

See Glazed Brick & Tile

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Ceresin

ESIN is also known under the names of erisine, cerosin, cerin, purified ozoker- rth wax, and mineral wax. It is encountered in white, waxy cakes, and is odorless and tasteless. Formerly, ceresin was a purified product of the mineral wax, ozokerite, obtained by treatment with sulfuric acid, followed by washing and neutralizaton of the acid. However, at the present time paraffin and similar mineral wax materials are incorporated into the commercial ceresins.

Several varieties of ceresin are commercially available, differing in their melting point ranges. The three most important are 138-40° F.; 150-60° F.; and 160° F. and above. All are packed in bags. Imports of ceresin into the United States in 1939 were 235,063 pounds, valued at $31,442. Of this quantity, 227,176 pounds, valued at $30,036, originated in the Netherland Indies, and the remainder in Italy, Germany, and France. During 1940, imports totaled 400,207 pounds, valued at $60,791. Since the outbreak of the war several European manufacturers of ceresin and similar amorphous mineral waxes have migrated to the United States and commenced production of such materials here.

The price of the 138° ceresin on June 1, 1942 was quoted at $13\frac{1}{2}$¢ per pound; and the 150-60° material at $15\frac{1}{2}$¢ per pound. On January 1, 1942, the two varieties were $13\frac{1}{2}$¢ and $16\frac{1}{2}$¢ per pound respectively; while at the start of 1941 they were 11¢ and 13¢ per pound. The 160° wax is generally priced one cent above the 150-60° variety.

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Ceresine

See Ceresin

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Cerin

See Ceresin

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Cerium

CERIUM is a steel grey metal of the rare earth group, obtained from ores such as Cerite, Samarskite, Monazite and Allanite by electrolytic and chemical processes. Allanite and samarskite ores are found in Virginia and North Carolina while Monazite occurs in Florida, Australia, Brazil and Indian beach sands. Production of Cerium metal probably does not exceed 25,000 tons annually but Cerium salts have a much greater production. It is used as an oxide in gas mantles, as a

metal in pyrophoric alloys and in the form of water soluble salts as a rot-proofing agent in textiles. Some oxide is used in special glasses and enamels. The metal is sold by the pound, recent prices ranging from $7.00 to $10.00 per pound. It is transported in sealed containers via rail and truck and will keep indefinitely if not in contact with air. Otherwise, it oxidizes very rapidly. Commercial Cerium is a mixture of Cerium, Lanthanium, Neodynium and Praseodymium metals. Its chief use is in the manufacture of Ferro Cerium for pyrophoric alloys (lighter flints). The war has interfered little with the production of Cerium metal or salts. There are domestic sources for ore although the principal ores have come from India, Brazil and Australia.

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Cerosin

See Ceresin

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Cerrusite

See Lead

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Cevitamic Acid

See Ascorbic Acid

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Chalk

COMPOSED of finely pulverized marine shells, chalk is a fine-grained limestone or soft, earthy form of calcium carbonate. It comes largely from the famous chalk deposits along the southern coast of England and from the north of France. Domestic chalk is obtained mostly from deposits of high-calcium marbles and limestones with which, of course, chalk is closely allied.

Whiting and Paris white are applied to chalk which has been ground for use in paints, inks and putty. Chalk is also employed in putty, crayons, paints, rubber goods, calcimine and as a mild abrasive in polishes. The color varies with the impurities and commercial grades show a great variance as to color and fineness.

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Chamois

CHAMOIS is a specialized type of leather, distinguished by its soft absorbent qualities which make it ideal for cleaning and polishing purposes. It is produced from selected sheepskin, from which the grain or skiver has to be split. It is then tanned, 100% with marine oil, usually cod oil for maximum softness, strength and absorbency. American sheep, because of climatic conditions, have too thin a hide for chamois use and consequently raw hides are imported from Australia, New Zealand and Great Britain. Coming from the Far East, they are preserved in a brine solution which does take some life out of the skin. About five million dollars' worth are processed annually in the United States. They are marketed in "kips" of 30 skins, or by dozens. Quotations vary with the quality. Shipment from England is in bales or wooden cases. Types are classified principally according to the skin's weight or thickness and graded by uniformity and freedom from thin or rough spots. The thicker types are further classified as to whether they have been buffed on one or both sides. There is, so far, no satisfactory substitute. The U. S. import duty is 20% ad valorem.

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Cheese

CHEESE is made from the curd of milk, mainly from cows. However, it can also be produced from the milk of goats and ewes. Whole milk, skimmed milk or

skimmed milk and cream furnish the materials for cheese. Separation of the curd from whey is effected by the use of a coagulating agent, usually rennet or pepsin.

Cheese production is highest during the period of best pasture season—June to October in the north, over a somewhat longer period in the south. Plenty of pasturage, clear water, good care and shelter of dairy herds is essential to the production of good cheese, for cheese can be only as good as the raw material from which it is made, fluid milk. First essential in the production of high quality cheese is production of high quality milk.

The leading cheese producing states are Wisconsin, New York, Illinois, Indiana, Oregon, Texas, Minnesota, Michigan, Ohio and Missouri. Cheese production in the decade prior to the war, exclusive of cottage, pot and bakers' cheese, ranged from about 480 to 725 million pounds annually. The production trend has been steadily higher.

Virtually all major cheese types are today produced successfully in this country. Camembert, Roquefort-type cheese, Goudas, and many other types which used to be thought of as "foreign" type cheese exclusively as well as some distinctive American types are produced excellently here today. Imports of cheese to this country have been a relatively unimportant factor in the total cheese industry of the United States for many years. But the coming of the war to Europe automatically cut off all cheese imports from that section. Some cheese is imported from South America.

Marketing of cheese previous to the introduction of package cheese was principally handled in the following channels. Natural cheese, made in small country cheese factories, was assembled by a country assembling dealer. It was the function of the assembler to concentrate the output of a number of factories, to grade and allot it according to the demands of the particular markets which he supplied. Cheese was assembled in warehouses for distribution, generally in car-lot shipments, to terminal wholesalers, who in turn sold direct to retailers. In some cases, wholesalers used brokers to contact the assembling dealer, or the individual factories. Distribution to retail outlets was generally effected by wholesale grocers, sometimes working through brokers. Last step in this distribution system was the purchase by retail grocery stores of small amounts of cheese—an individual wheel of American cheese at a time, for example—from the wholesale grocer. Quality of cheese as it reached the retail stores was highly variable.

The introduction of process package cheese in 1920, made possible the most important development in cheese marketing in this country. Process cheese made possible packaging in convenient package-sizes which could be marketed and consumed without loss or waste. It also made possible a product of high keeping quality and uniform flavor and texture. Processors of cheese, in order to produce package cheese of uniform flavor, require large volumes of cheese of varying degrees of sharpness. To maintain constantly the large volume of cheese required for the package product, the producers of package cheese maintain large warehouses for assembling cheese and for storage, near main sources of supply. Output of many small factories, some owned by the process cheese manufacturers, some independently owned, is gathered into these central warehouses. From assembling plants, large volumes of cheese go to central processing plants, where cheeses are carefully tested, graded, and blended to produce the uniform packaged product.

The classification of grades of cheese is a diverse, complicated and important matter. Grades for American cheese, for example, must differ from those for Cream

Cheese—and so with each of the many types of cheese in this country. Various dairy states have set up their own methods for grading various types of cheese. The State of Wisconsin, for example, has done a notable job in grading and branding various state grades.

Cream cheese, a soft uncured type of cheese, is almost as perishable as whole milk itself. Hard cheeses, such as Swiss and American cheddar, have relatively much higher keeping quality. But each and all of the many dozens of varieties, made up of hundreds of styles, sizes and package types, must be carefully handled.

The most important variety made in the United States is American Cheddar. The American Cheddar weight is seventy pounds per cheese. Other sizes of American Cheese are Daisies, Longhorns, Young Americas, Flats and Prints. The duty is as follows:

Emmenthaler or Swiss with eye formation —1 lb.: 7¢ lb., 35% min.; 7¢ lb. Switzerland, 20% min. Switzerland; 5¢ lb. Finland, 20% min. Finland.

Guyere process-cheese—1 lb.: 7¢ lb., 35% min.; 7¢ lb. Switzerland, 20% min. Switzerland; 5¢ lb. Finland, 20% min. Finland.

Romano or Pecorino—1 lb.: 7¢ lb. 35% min.

Reggiano or Parmesan—1 lb.: 7¢ lb., 35% min.

Provoloni and Provolette—1 lb.: 7¢ lb., 35% min.

Roquefort in original loaves—1 lb.: 7¢ lb., 35% min.; 5¢ lb. France, 25% min. France.

Cheddar cheese whether or not in original leaves, but not including any cheese processed otherwise than by division into pieces —1 lb.: 7¢ lb., 35% min.; 4¢ lb. Canada, 25% min. Canada.

Blue-mold cheese in original loaves—1 lb.: 7¢ lb., 35% min.; 5¢ lb. France, 25% min. France.

Edam and Gouda cheese—1 lb.: 7¢ lb., 35% min.; 5¢ lb. Netherlands, 25% min. Netherlands.

Other—1 lb.: 7¢ lb., 35% min.

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Chemical Pulp

See Paper

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Cherry

See Hardwoods

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Chestnut

See Hardwoods

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Chestnuts

The chestnut is the sweet edible nut produced by any of several varieties of chestnut trees. The American chestnut is considered the best in flavor, and appears on the market in late September or early October. Domestic production was sharply cut by a blight several years ago, which killed many of the producing orchards; new trees are now reaching the production stage.

Spanish chestnuts, running larger in size than the domestic, are also sold in the American market. Marrons, a large chestnut produced in Italy and France, were formerly widely sold in this country; in bottled form, in syrup or other preservative, and used for frozen desserts.

The imported nuts are packed in barrels, baskets, and cases of various weights; the domestic is packed and shipped in 100-110-lb. boxes.

Chestnuts are bought from the grower on the basis of the pound, and marketed in this fashion. Domestic production comes largely from Oregon and Washington. Data on production in recent years are not available, but the chestnut is a minor factor in the nut mar-

ket. Current prices are not available, as these nuts have been off the market since late in 1941.

In common with other nuts, chestnuts are susceptible to weevil infestation and require cool storage. They may be shipped by either rail or truck.

Import duty on chestnuts is 25 cents per pound for candied, crystalized or glaced nuts; crude dried are duty free.

Chestnuts do not come under the provisions of the General Maximum Price Regulation.

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Chicle

CHEWING GUM—a popular American product—contains anywhere from 25 to 100 percent chicle, as a base material.

Crude chicle is the coagulated latex of a tree (Achras Sapota) native to Central America and adjacent regions. After refining, the chicle is used in the manufacture of a chewing gum base, usually together with other materials such as jelutong. Chicle oxidizes rapidly. It is more plastic than rubber and more elastic than gutta-percha.

Virtually the entire world production comes from Mexico, Guatemala and British Honduras, although small quantities are produced in Colombia, Venezuela, Brazil and the Guianas. In 1938, Mexico exported 7.3 million pounds which was 74 percent of total world exports for that year. In addition, Mexico probably consumed an additional million pounds in the manufacture of chewing gum. During the same period, Guatemala exported 17 percent of the world total, and Honduras 9 percent. British Honduras, because of its location, reexports substantial quantities of Mexican chicle. The production and export trade in chicle are largely operated by United States interests. Most exports are in crude form.

The United States is the principal market for the commodity, taking nearly 90 percent of all exports. Imports were 12,416,000 pounds in 1940. Most of the remainder goes to Canada and the United Kingdom, and is shipped from British Honduras in normal times. United States chewing gum interests have subsidiaries in both Canada and England. The output of chewing gum in the United States, in 1937, was valued at 55 millions of dollars. In 1938, the unit value per pound of crude chicle was 29.5¢, against 25¢ in 1937, 16.8¢ in 1933; and 43.4¢ in 1929.

While crude chicle enters the United States free of duty, the refined or advanced chicle is taxed at the rate of 5¢ per pound. Chicle is free of duty in both the United Kingdom and Canada if produced in or entered from Empire countries. Producing countries obtain considerable revenue from chicle through various forms of taxation.

The proportion of chicle in chewing gum base may range from 25 percent or even less to 100 per cent. Jelutong and the various guttas used in the production of such bases are, therefore, both complementary to, and competitive with, chicle.

The wholesale price of chicle, which is marketed in quintals of 46 kilos (101 pounds) was 42¢ in late April 1942 for "prime, 33 percent moisture."

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Chicory

CHICORY is the product of a common, European perennial plant, also cultivated in the United States. The roots are carrot-shaped, 12 to 14 inches long, and gray-white in color. The normal domestic yield is five tons per acre on a planted acreage of about 7,000 tons. Most prominent producing area is the state of Michigan. After harvesting in the fall, the roots are hauled to dry kilns where they are washed, sliced and dried. In this form, chicory is held for indefinite periods and is roasted to order. Usually, it is

roasted and ground to the color and size of coffee. The finished product is used by coffee roasters and food processors for flavoring. Marketing to the consuming trade is chiefly in bulk, either in 150-pound bags or carload lots. Sometimes it is sold in packages. There is very little flavor deterioration in storage but some caking because of natural invert-sugar content, especially in hot weather. Principal types are Bulk, in granulated form; and Powdered, in bulk or packages. U. S. import duty on the dried (raw) root is 1½¢ per pound and 2½¢ per pound on the finished product.

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China Clay

ALTHOUGH clay in the general sense is a widely distributed earth which, when moist, is pliable and when dried and heated becomes hard and water-resistant—the commercial clays all have special distinguishing characteristics. Clays are smaller grained than silt, less than 0.002 mm. in diameters. Silica and alumina are found in all clays, usually together with the mineral kaolinite or some similar mineral. Kaolins, or china clays, are the purest type. Most clays also contain quartz, mica, feldspar, etc. Fuller's earth is a bleaching clay. Bentonite is another special clay.

Kaolin, also called china clay, is a hydrous aluminum silicate. It has a dull luster and a specific gravity of 2.6. As found it usually contains impurities in the form of quartz, feldspar and mica which can be washed out. In its pure state it will not melt at temperatures under 3200° F. Iron is an undesirable constituent. Among the better-known foreign clays are the Cornwall kaolin of England and the Limoges kaolin of France. Another British clay is Cornish clay also known as China stone. Ball clay is a Kentucky and Tennessee product of a light color when fired, a high purity and of good bonding strength.

Total United States production of all kinds of merchant clay in 1940 broke all records at 4,847,519 short tons valued at $19,633,-568. Increased use of American clays in ceramic whiteware, the last stronghold of imported clays, is in full swing. However, the war did not entirely halt the shipments from England — the clay serving as good ballast in returning ships. Total imports of clay in 1940 fell to 140,447 tons, valued at $1,159,790 against 151,957 tons in 1939. Exports in 1940 were 184,168 tons against 136,480 tons in the previous year.

United States production figures, of course, do not include the many times greater quantities of clay mined by manufacturers of brick, tile and other heavy-clay products, for their own use or nearby plants, but only to clay sold or shipped raw.

Uses for clay (excluding fuller's earth) in the United States in 1940 were as follows: pottery and stoneware 229,294 tons, including 184,202 tons for whiteware, etc.; tile 51,713 tons; kiln furniture 48,233 tons; architectural terra cotta 21,922 tons; paper filling and coating 496,099 tons; rubber 102,744 tons; linoleum and oilcloth 18,123 tons; paints 12,859 tons.

Domestic sales of china clay, or kaolin alone, reached a new high of 833,450 tons in 1940. Further expansion in the demand for American paper clays, both for coating and filling paper, explained most of the increased business. Of the total quantity sold, the paper industry consumed 50 percent and the rubber industry 11 percent; another 11 percent went to pottery and tile manufacturers, 9 percent for refractories; and 5 percent for cement.

Production of domestic ball clay amounted to 140,707 tons in 1940, valued at $1,065,-432. In 1940, 80 percent of the shipments of domestic ball clay was used in pottery and stoneware, 14 percent in high grade tile and

the remaining 6 percent in miscellaneous products. Kentucky and Tennessee accounted for more than 90 percent of the ball clay output.

Shipments of domestic fire clay were 2,765,247 tons in 1940 valued at $7,046,746. Ordinarily, consumption of fire clay follows closely the index of iron and steel production due to the clay needed for refractories. Increased utilization of kaolin refractories and the sharply expanded production of bentonite for foundry consumption, has lessened the demand for fire clay for that purpose.

Although no figures are available on the amount of clay dug and used for brick, tile, sewer pipe and other heavy-clay products, it is believed this figure would be six to nine times as large as the total for all kinds of merchant clay. Sales and use by United States producers of miscellaneous clays, including slip clay and shale, totaled 710,515 tons in 1940 valued at $1,136,740. Miscellaneous clays are used for rotary-drilling mud, in cement manufacture, in foundry and steel works, in flowerpots and other earthenware, in oil refining, and for a variety of minor uses.

In July 1942, domestic china clay, dry-grade, air-float, 99.75%, 300 mesh, in bags, carload lots, at works were priced at $9.50 per ton. Bulk lots were $7.60 and less-than-carload lots $16.00. The net grade, silk-bolt, 99.9%, 325 mesh, bulk carload at works was quoted at $9.50. Imported clay, white, lump, in bulk on a carload basis, ex dock Baltimore, Boston, Norfolk or Philadelphia, ranged from $19.00 to $24.00 while "powdered," in less-than-carload lots, ex warehouse was priced at $41.00 per ton.

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China Stone

See China Clay

Chinawood Oil

See Tung Oil

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Chinese Insect Wax

CHINESE insect wax is also known simply as insect wax, as Chinese tree wax, and as vegetable spermaceti. It is a white to yellowish solid, having no, or little odor or taste. It resembles spermaceti (qv), being a little harder and more friable. The wax is produced by secretion by a scale insect found in China and parts of India, and is deposited on some species of ash trees. The wax is removed by hand, melted in boiling water and then strained or filtered to remove particles of bark and dirt. It is packed in bags and barrels. Chief use of the material is in making candles, paper sizings, polishes of various kinds, and in treating textiles. The supply of wax is uncertain and limited.

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Chinese Tree Wax

See Chinese Insect Wax

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Chlorine

CHLORINE at ordinary temperatures is a corrosive, suffocating, greenish yellow gas. Commercially, it is compressed into liquid form by means of refrigeration, or compression, or both. It is packaged in heavy metal containers. The liquid has small quantities of bromine, organic compounds and dissolved gases in the amount of not over 0.1% by weight.

Chlorine is produced commercially by electrolysis of brine. The chlorine formed at the anode is collected, dried with sulfuric acid and converted into the liquid form. During electrolysis, caustic soda is also produced which, together with caustic soda

otherwise produced, frequently results in the overproduction of this material. Since both chlorine and caustic soda must be sold or used so that the operation as a whole is profitable, a balance between these various productions must be maintained. Chlorine is also produced, to a very limited extent, in the production of sodium nitrate from salt and nitric acid.

Chlorine is used in the paper industry for the bleaching and preparation of pulp; in the textile industry, for the bleaching of cotton and viscose; in the chemical industry, for the manufacture of chlorinated organic products and inorganic salts; in the mining industry, for the treatment of ores and in the treatment of water for sterilization. It is also employed in the manufacture of poison gases for military use.

Chlorine is quoted at about 5.25 cents per pound. It is supplied in cylinders varying in capacity up to 150 pounds and in single and multiple unit tank cars. The production of chlorine in 1939 amounted to 490,256 tons.

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Chloroform

CHLOROFORM, or trichlormethane is a clear, colorless liquid, having a characteristic ethereal odor and a burning, sweet taste. It is not inflammable, but its heated vapor is poisonous and burns with a green flame. Chloroform is slightly soluble in water, and miscible with alcohol, ether, benzene, and fixed and volatile oils. It is produced industrially by reacting bleaching powder (chlorinated lime) with acetone. Sodium hypochlorite and ethyl alcohol may also be reacted to produce chloroform.

Technical and medicinal grades of chloroform are marketed. The medicinal, or United States Pharmacopeia grade is important for anesthesia and contains from ½ to 1 percent of alcohol to retard the formation of deleterious compounds. The industrial material is used as a solvent, as a spotting fluid in dry-cleaning, and in organic synthesis. The U.S.P. grade is packed in 25-pound tins, and 7-pound, 5-pound, and 2-ounce bottles. The technical material is packed in drums containing 650, 100, 50, and 25 pounds, and in tins containing 10 and 5 pounds.

In 1940, production of chloroform in the United States totaled 3,078,521 pounds. In 1939, 2,933,322 pounds were produced. The price of technical chloroform in recent years has been 20¢ per pound; the U.S.P. grade has been selling at 30¢ per pound.

* * *

Chloropicrin

CHLOROPICRIN is a water-white liquid (CCl_3NO_2), 99.5% guaranteed purity, specific gravity of 1.65 and boiling point of 112.4°C. It is produced from picric acid and is used with stannic acid as a poison gas and fumigant. It is a lethal and lachrymatory poison. There are no known imports into the United States nor are there any figures on domestic production, but the principal producers are located in Wisconsin and N. Y. It is marketed in steel cylinders and 1 pound bottles in cases. May, 1942, prices were 80¢ per pound in 180 pound cylinders and $1.25 per one pound bottle. It is fairly stable but may discolor with time. Only one grade is produced: Commercial 99.5% purity. Substitutes are other war gases and other fumigants.

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Chocolate

See Cocoa

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Chripotile

See Asbestos

Chromium

See Chromite

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Chromite

THE United States is dependent on imports from foreign sources for 99% of the ore, chromite, source of the important metal chromium. In 1940, imports of chromite totaled 657,689 short tons while shipments from domestic mines were but 2,662 tons.

Chromium is a metallic element (Cr) occurring in nature only in combination with other metals. High-grade metallurgical lump ore, according to specifications, should contain 45 percent chrome oxide, and a chrome-iron ratio of about one to three. Chromium is a very hard metal with a specific gravity of 6.92, a melting point of 1615° C. and a boiling point of 2200° C. It is inert to nitric acid but dissolves in hydrochloric acid and slowly in sulphuric acid. As a plating material, it is resistant to corrosion and when highly polished will dispel water. Chromium metal indicates a pure grade of chromium containing 97 to 99+ percent chromium and not more than 0.5 percent iron with a low carbon content, about 0.1 percent. Chromium (97-99%) was quoted early in June, 1942, at 84¢ per lb. (contract) and 89¢ (spot).

Record imports of chromite into the United States in 1940 were double the 1939 figure, mostly as a result of Government stock-pile activities. Demand for chromite in 1940 was running at the annual rate of 600,000 tons per year and has since been increased. The development of domestic production, which totaled less than 3,000 tons in 1940, was surveyed but no appreciable deposits of high-grade metallurgical ore were found. Except for a small quantity from Oregon, the entire output was from California.

The chromite imported in 1940 contained an average of 46 percent Cr_2O_3 (Chrome oxide)—a 10 per cent increase over 1939 due to larger receipts from Africa where the Rhodesia output is particularly high-grade ore. U. S. imports in 1940 were 657,689 short tons with 301,672 tons of chromic content. Africa led with 285,559 tons (from southern Rhodesia and the Union of South Africa); next followed the Philippines, 156,566 tons; Turkey 70,081 tons, Cuba 51,955 tons (the Cr_2O_3 content but 33 percent); New Caledonia 42,861 tons; British India 32,644 tons; Greece 14,041 tons; and all other countries 3,982 tons.

Available data revealed that in 1940, excluding Russia for which no figures were available, Turkey was the largest producer (about 200,000 tons), followed by Southern Rhodesia and the Union of South Africa. Germany does not produce chromite but depends on Turkey principally for her supply. Many sources of German supply have been cut off since the war began.

Domestic uses for chromium fall into three general categories. The first and most important is for metallurgical purposes, accounting for about 60 percent of the country's consumption; second, for the lining of refractory furnaces which consume about 28 per cent of the ore; and finally, for making chromium chemicals, which account for the remaining 12 percent.

The steel industry consumes more than three-fourths of the supply of chromite either in refractories or as a source of an important alloying element.

For the purpose of the manufacture of alloy steel, chromite is converted into ferrochromium in the electric furnace before it is added to the steel bath. Standard grades of ferrochromium contain 60 to 70 percent chromium and a lower content is not generally acceptable. Although chromium is used in many alloy steels, its largest and best-known use is in the manufacture of stainless

steels. Increasing quantities are being used also in the field of low-alloy, high-strength steels, where chromium imparts strength and adds to corrosion resistance. In recent years chromium plating has had a wide field of use and become important industrially, but the amount of raw material consumed is small owing to the thinness of the layer of metal. For decorative purposes, a coating as thin as 0.0002 inches is used but for wear-resistant plates up to 0.05 inches are employed.

Chemically, in addition to the use in the manufacture of chromic acid for electroplating, considerable quantities of chromite are consumed in chemicals employed principally in dyeing, tanning and pigment industries. The supply of ore suitable for chemical uses is regarded as plentiful, and the amount available for refractory purposes is also ample.

Tanning leather is one important use for chromium chemicals, while the manufacture of chrome pigments has increased. The protective coating which inhibits corrosion, provides a source of camouflage for planes, ships, etc. Use is also found in the textile industry as a mordant for the treatment of wool, and makes possible the fast khaki and olive drab color of tents, uniforms, etc. A new use for chromic acid has been as an oxide film or skin on aluminum which stops corrosion and affords a base for subsequent painting. This treatment is being widely used in the aircraft industry and is required by a number of Government specifications.

The War Production Board, through amended Order M-18-a and Supplementary Order M-18-b limits the use of chromium ores or concentrates in chromium chemicals, restricts melting and directs deliveries, prohibits certain uses (manufacture of roofing material, ceramics, soap or glass) restricts inventories, etc.

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Chrysotile

See Asbestos

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Chub

See Whitefish

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Chutney

A SWEET, highly spiced relish made largely from mangoes, sugar and spices. It is a product of British India and used as a condiment, particularly with curry dishes. The marketing unit is the barrel. The price (1942) was £35-0-0—£90-0-0 per ton F.O.B. India. It is transported by freight steamer and is semi-perishable depending on the type of packing. The principal grades are Major Grey and Bengal Club. The duty is 35% ad valorem.

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Cinchona Bark

See Quinine

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Cinnabar

MERCURY SULPHIDE (HgS), brownish red in color; of granular structure. It is mined from ores yielding from 4 to 10 lbs. metallic mercury per ton. Metallic mercury extraction is usually by retort (distillation). It is produced principally in the States of California, Oregon, Nevada, Texas, Idaho and Oklahoma—the United States yield running to about 40,000 flasks out of a world production of about 150,000 flasks. Leading foreign producers are Spain, Italy and Mexico. Its principal use is as metallic mercury and mercury salts, pharmaceuticals, paints, and lately war materials. The market unit is 76 lbs. or 34½ kilos, and a ceiling price was fixed at $191.00 per flask (76 pounds) f.o.b. West Coast. It is customarily shipped in steel or

iron flasks by water, rail and motor. The principal grade is, "Prime Virgin—Redistilled." There are no commercial substitutes at this time. The United States import duty is currently 25¢ per pound, or at the rate of $19.00 per flask.

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Cinnamon Oil

SEVERAL varieties of cinnamon oil are encountered in commerce. Most important is cinnamon-leaf oil. Cinnamon-wood oil is of secondary importance, and a cinnamon-rootbark oil is only seldom seen. The leaf and wood oils are pale yellow in color and have the distinctive cinnamon odor and taste. Both are obtained by distillation of the leaves or bark-wood, as the case may be, of Cinnamomum zeylanicum, which is native to Ceylon and also cultivated there and in other islands of the East Indies.

Two types of cinnamon-leaf oil are found in the trade, a Seychelle cinnamon oil and a Ceylon cinnamon oil. The Seychelle oil is less expensive, since it has a lower content of cinamic aldehyde, the chief constituent of cinnamon oils, and a higher content of eugenol, which lends a clove-like note to its odor and taste. In 1940, imports of cinnamon oils into the United States were 184,673 pounds, valued at $112,008. Of the total, 183,829 pounds were cinnamon-leaf oil, valued at $93,919. The Seychelle Islands contributed 123,378 pounds of cinnamon-leaf oil during 1940, and Ceylon shipped 57,477 pounds.

In 1939, 226,745 pounds of cinnamon-leaf oil, valued at $94,433, were imported into the United States. Of this amount, 114,573 pounds originated in the Seychelle Island, while 111,442 pounds came from Ceylon. During 1939, cinnamon-wood and root oil imports totaled 1,477 pounds, valued at $25,665.

Cinnamon-leaf oil is packed in 25-pound tins in commerce; the wood oil is put up in one-pound bottles or canisters. Cinnamon-leaf oil is used in soap perfumes and in flavoring foods and medicines. The wood oil is preferred as a flavor in medicinal and dental preparations, and in perfume combinations. Pricewise, cinnamon-wood oil was nominal on June 1, 1942, since stocks were small. At the beginning of 1942, however, the wood oil was being quoted at from $11.00 to $32.00 per pound, according to quality. In January, 1941, the price ranged from $10.00 to $27.00. The leaf oil on June 1, 1942 was $2.50 per pound. At the beginning of the year it was priced at $2.00 per pound.

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Cisco

See Whitefish

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Citric Acid

CITRIC ACID occurs as colorless crystals or white powder. It is present in the juice of many fruits, particularly the citrous fruits and pineapples. Commercially it is obtained from both these sources in substantial volume. Generally the juice is fermented slightly to precipitate mucilaginous materials, then calcium carbonate is added to obtain the citrate, which is separate and subsequently decomposed with a mineral acid to reform citric acid. Tartaric acid, which is also present in many fruits, may be present as an impurity in the citric acid. Citric acid is also made by fermentation methods.

Anhydrous, granular and crystalline forms of citric acid are marketed. The United States Pharmacopeia demands that material for medicinal use be at least 99.5 percent pure. Crystalline citric acid is packed in 230 pound barrels, 112 pound kegs, boxes containing from 5 to 50 pounds, and smaller cartons. The powdered material is packed in

200 pound barrels; and kegs, boxes and cartons containing the same weight as the crystalline acid. The price of the crystalline material in recent years has been 20¢ per pound. The anhydrous material has been about 3¢ more expensive per pound. Industrially, citric acid is used in calico printing and electroplating operations. Principal use, however, of the acid is in the soft drink field, as a flavor. An important amount is also consumed by the pharmaceutical and medicinal industries.

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Citronella Oil

CITRONELLA OIL is a yellow oil distilled from the grasses of the Cymbopogon nardus variety found growing in India, Ceylon, Straits Settlement, Java, and other tropical countries. Commercially Javanese, Ceylon, and Singapore types are encountered. The principal constituents of citronella oil are citronellol and geroniol, each of which is present in amounts varying from 25 to 45%. The oil is employed in medicine, as a perfume ingredient and agent, particularly in soaps, and as an insect repellent. Citronella oil is closely associated in commerce with lemongrass oil (q.v.).

Citronella oil imports in 1940 amounted to 2,902,685 pounds, valued at $700,423. The Netherland Indies furnished 2,369,312 pounds of the foregoing. In 1939, 2,744,140 pounds, valued at $655,953 were imported, with the Netherland Indies supplying 1,942,-260 pounds. Drums of about 400 pounds and tins of about 50 pounds are employed in packing citronella oil. A redistilled oil is also offered in 50-pound tins.

The price of citronella oil on June 1, 1942 was $1.30 per pound. On January 1, 1942, the price was $1.00 per pound. At the start of 1941, citronella oil was 37¢ per pound.

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Citron

CITRON is the preserved rind of the fruit of the citron tree. It resembles the lemon in appearance, but is larger and not umbonate. While pre-war supplies came largely from Italy, Puerto Rico and California are now the principal suppliers for the American market.

It is marketed in cured form and used largely by the baking industry, principally in fruit cakes and fancy cookies, and is likewise marketed direct to the consumer for home cookery in small units. Limited quantities are used in confectionary manufacturing, largely in glace fruit assortments.

Commercial grades are halves and "diced". Detailed data on production are not available.

Citron is shipped largely in brine, in barrels of approximately 400 pounds each, and then cooked in sugar for commercial sale.

The unit of trading is the pound. The cured product is packed largely in 5, 10, and 25 pound boxes for commercial distribution. with consumer package sizes ranging from 3 to 4 ounces on the average.

July, 1942, prices for citron ranged from 34 to 38 cents per pound for halves, with broken citron 32 to 33 cents per pound.

Citron in brine has indefinite keeping qualities in ordinary storage, but the sugared product must be carefully handled to prevent quality deterioration and loss of marketability. Citron is shipped largely by rail or truck.

Orange and lemon peels are used as the substitutes for citron. They are packed in comparable sized containers, and with processed orange peel were quoted at 22 to 27 cents for halves and lemon peel 2¢ higher, while on "broken", prices for both substitutes range from 19 to 19½ cents per pound. All three products are used to some extent by fruiterers in fancy fruit assortments. Lemon and orange peel are subject

to the same storage conditions as govern citron.

Duty is 6 cents per pound for candied, crystallized, or glace citron. Citron in brine and crude and dried are duty free.

Citron comes within the provisions of the General Maximum Price Regulation when packed in other than hermetically sealed containers.

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Clove Oil

CLOVE OIL, sometimes known as caryophil oil, is a pungent, yellow oil obtained from the unexpanded flower buds of Eugenica aromatica by distillation. The United States Pharmacopeia specifies that clove oil to be official must have a eugenol content of at least 82%. Madagascar is the principal source of the oil, while appreciable amounts of cloves are also harvested in Zanzibar, Penang, and the Molucca Islands. Considerable oil is distilled in this country from the imported cloves.

United States imports of clove oil during 1940 amounted to 307,289 pounds, valued at $133,695. Of this quantity, Madagascar supplied 302,671 pounds and France 4,606 pounds. In 1939 the total of imports were 168,032 pounds, valued at $71,525. In the latter year Madagascar exported 157,037 pounds to this country; France, 4,851 pounds; and British East Africa, 4,345 pounds. Commercially clove oil is packed in tins of 60 pounds and bottles containing 6 pounds. In addition to a regular grade, twice rectified and extra fine grades are also offered.

Because of the aromatic nature and antiseptic qualities of clove oil it finds extensive use in toothpastes and oral preparations. It is also much used in soap perfuming compositions and in flavoring combinations. Clove oil on June 1, 1942 was priced at $1.75 in large quantities. At the first of the year, it was lower, at $1.40 per pound. During the first month of 1941, the price of the oil was $1.05 per pound.

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Coal

THE leading source of heat and power is coal, a solid, combustible mineral substance formed by the partial decomposition of vegetable matter. It is black or brownish-black in color.

Coal has been formed from vegetable matter such as wood, bark, leaves and spores, which were deposited in primeval peat swamps. This material was eventually covered with thick layers of mud and sand, and through long geologic ages the tremendous pressure of the overlying strata and mountain-building forces gradually converted the vegetable matter into coal of various kinds. In spite of the great age and degree of alteration of most coals, microscopic examination shows that abundant plant-cell structure still remains in every lump.

The principal classification of coals is by rank, that is, according to their degree of alteration in the natural series from lignite to anthracite. Following ten years of intensive study by representative committees of engineers and scientists, American standards for the classification of coal were adopted in 1937. Coal is divided into four main classes; anthracitic, bituminous, subbituminous and lignitic. Each of these is further divided into two to five groups, making a total of 13 groups. The most important coals in the United States are anthracite, or hard coal and bituminous or soft coal.

Where coal seams lie close to the surface, they may be mined by stripping off the overlying strata with large steam shovels.

Coal is usually obtained by underground mining. When the coal seams are exposed in hillsides, entries are driven directly into

the seam, taking advantage, where possible, of the natural slope to provide drainage and to facilitate the removal of loaded mine cars. However, shafts are often necessary, in which case the coal must be hoisted and water pumped out of the mine.

Various systems of mining are in use, depending upon the thickness and character of the coal seam and overlying strata, the type of mechanical equipment available, and other considerations. Many problems must be met, such as mine drainage, ventilation and safety measures to conform to mining laws, disposal of refuse material, and transportation problems beneath and above ground.

Labor represents a high proportion of the total cost of producing coal, and mine mechanization has made rapid strides. At least 85% of the bituminous coal mined underground is now cut by machines to facilitate dislodging by explosives. Anthracite mining is inherently more difficult and expensive than typical bituminous coal mining, and mechanization involves special problems. Only a small percentage of anthracite is cut with machines, but the percentage mechanically loaded underground is about the same as with bituminous coal.

The preparation of bituminous coal begins underground at the time of mining. Bands of impurities may be cut out of the seam, or less desirable roof or floor coal may be left in the mine. At the tipple above ground, the coal is usually sized and handpicked, or it may be subjected to special cleaning processes. The highly competitive market has caused a great increase in coal cleaning facilities in recent years. Sixty-one million tons of mechanically cleaned coal were produced in 1936.

Anthracite is nearly always subjected to elaborate crushing, screening and washing processes. Some of the individual anthracite breakers represent an investment of millions of dollars.

The United States contains slightly more than one-half of the world's known coal supply, or about 3 trillion tons, which may be compared with our present annual production of about one-half billion tons or our total commercial production to date of 24 billion tons. More than half of the reserves consist of low-rank coals, and almost 70% lies in the West, far from centers of population and industry. At the present rate of disappearance, the Nation's reserves of bituminous coal are sufficient to last for more than 3,000 years and Pennsylvania anthracite about 150 years. Certain grades may become scarce in much less time, and some small local fields are approaching exhaustion at present.

The leading producing states are West Virginia, Pennsylvania, Illinois, Kentucky, Ohio, Indiana, Virginia and Alabama. West Virginia leads in bituminous production while Pennsylvania supplies almost all of the anthracite coal mined in the nation.

Bituminous production in 1941 amounted to 511,290,000 short tons against 460,772,000 short tons in 1940. The output of anthracite in 1941 totaled 54,351,000 short tons compared with 51,485,000 short tons in 1940.

The principal markets are: use by manufacturing industries for power and heat; house heating; locomotive fuel; manufacture of coke and gas; and use by electric power utilities. Anthracite in the larger sizes is used principally for house heating, while the small sizes are used for steam generation with an increasing percentage being used in residential and small commercial stokers to provide automatic heat.

The marketing unit is the ton. The composite price for bituminous (wholesale, mine run) was $4.774 per short ton in April, 1942. The composite wholesale price of anthracite (chestnut) in April 1942 was $10.114 per short ton.

Coal leads all other commodities in point of tonnage, so that its transportation is an economic factor of national importance. In the United States, most of the bituminous

coal is shipped by rail, often for long distances. The revenue tonnage of anthracite, bituminous coal and coke originating on Class I steam railroads is more than twice as great as the *combined* tonnage of all products of agriculture, animals and forests! Also, the coal tonnage is considerably greater than the revenue freight tonnage of all manufactured products and miscellaneous items.

Bituminous coal is one of the few commodities whose freight rate exceeds the value of the commodity at the point of production. Over a recent ten-year period, the average mine price of bituminous coal was $1.68 per ton, and the average revenue received by the railroads for handling it was 32% greater, or $2.22 per ton. Freight rates per ton mile are higher for anthracite than for bituminous coal.

Large tonnages of coal which originate on railroads are trans-shipped by water along the Great Lakes and eastern seaboard. Some 25 million additional tons originate at river mines and are shipped directly to their destination by water. High freight rates for short hauls have led to the growth in trucking for distances up to 100 miles and more.

Towards the middle of 1942, the industry was confronted with a serious storage problem at points of consumption. This was occasioned by the necessity of consumers to build up stocks against possible transportation delays when the peak movement of war materials set in. Freight subsidies were granted so that New England consumers would not be subjected to higher all-rail costs and the subsidies were granted in sufficient amounts to hold bituminous prices in line with October 1 to 15, 1941 levels. Coal shipments were given preference on solid trains to areas where congestion could be expected later. Maximum Price Regulation 120 placed wholesale coal prices at their October 1 to 15, 1941 maximum levels.

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Cobalt

THE use of cobalt has expanded during recent years and world production has increased greatly, although the United States is still dependent on imports for most of its requirements.

Cobalt is a silvery-white, tough lustrous metal occurring with iron, nickel and copper but also occurring in cobaltite, and smaltite. It has been taken from iron pyrites and recovered as a by-product of froth flotation of talc. It is malleable and refractory, with a specific gravity of 8.76 and a melting point of 2672° F. As an oxide it is one of the most powerful colorants of glass, one part of twenty thouand being all that is necessary to produce a beautiful blue color.

In 1940, imports of cobalt, almost all from the Belgian Congo, increased about 53 percent from the all time high registered in 1939. Imports of ore totaled 10,497,719 pounds; of the metal 130,321 pounds; the oxide 756,759 pounds and 11,468 pounds of sulfate.

Invasion of Belgium diverted the normal shipment of cobalt-bearing residues from that country to the United States for refining. These came from Belgian Congo and Northern Rhodesia and the United States and Canada installed equipment to convert the ores into finished cobalt products. In 1940, for the first time since 1931, there was a marketed production of cobalt ore from domestic sources, but it was extremely small.

World production of cobalt was estimated at about 5,000 tons in 1939 and no later figures are available. Belgian Congo produces about a third of this and, together with French Morocco and Northern Rhodesia, accounts for from 75 to 80 percent of the world's total output.

Cobalt oxide is used in the ceramics industry, cobalt salts are employed in the preparation of driers for use in paints, var-

nishes and linoleums and as a catalyst; and cobalt metal is utilized in cutting tools and drills, welding rod, stock for tipping tools, dies, valve steel, magnets, electroplating, and dental restorations. Cobalt too has been applied successfully to supplement pasture deficiencies that cause various types of sickness among animals. Its chief use, however, is for alloying with steel where it gives tremendous hardness. It imparts great wear resistance when cutting at red heats.

The domestic price for the metal (97 to 99 per cent purity) in 100 pound contract lots was $1.50 per pound in mid-1942; the black oxide (70 to 71 per cent grade) was quoted at $1.84 per pound.

The War Production Board by Order M-39 effective Nov. 4, 1941 restricted the deliveries of cobalt in all forms. Prior to this, on Jan. 6, 1941, exports of cobalt were prohibited without license. Early in 1942, the use of cobalt in the manufacture of specified articles was restricted to 40 per cent of the 1941 use, and after April 30 prohibited altogether. Restrictions were also imposed on use for items not listed, dependent on preference ratings. However, cobalt-nickel oxide, which cannot be practically separated into cobalt and nickel, may be used in the manufacture of ground coat frit.

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Cocoa

THE cocoa tree is exclusively a tropical plant and will not flourish in a climate where the temperature falls below 60°, nor at altitudes of more than 1,800 feet above sea level. The tree takes from five to seven years to mature to bearing.

The pods, about the size of small cantaloupes, grow out from the trunks of the trees. When ripe, these pods are cut down and opened; and the beans are taken out, fermented and cured. The dried beans are packed in jute bags for shipment to consuming centers of the world. The cocoa bean is the raw material for the chocolate industry. All New York Cocoa Exchange statistics refer to the dried, raw cocoa beans in original shipping bags.

The most important cocoa-growing country is the Gold Coast Colony of West Africa, a British territory which produces about 42% of the total world crop. Brazil is next with a total output of about 15%. The territory of Nigeria, in West Africa, ranks third with about 14% of world output. Other producing countries are the Ivory Coast (West Africa), the islands of San Thome and Principe, Costa Rica, Panama, Dominican Republic, Haiti, Trinidad, Venezuela, Ecuador, and the Islands of Ceylon, Java, Samoa, and the New Hebrides.

The cocoa of the Gold Coast Colony is commercially known as "Accra" after the principal shipping port of the colony. This type, together with the Brazilian cocoa, known as "Bahia" cocoa, constitute the basis, or standard growths. Products of other countries usually sell at premiums or discounts from these basic grades. Some of the finer and less plentiful Central and South American cocoas, called "flavor grades," are quoted at premiums of from a fraction of a cent to several cents per pound over the standard growths.

The premiums constantly fluctuate with changing supply and demand of the specific growths.

Most producing countries have a "main crop" and smaller "in-between" crops, known as "mid-crop." The following tables show when the crops of each country are harvested; also the percentage of each in relation to total world production and the approximate weight per bag of shipments from specific countries:

Country	Approx. % of Total	Cropping Season Main	Mid	Approximate Gross Weight per Bag
Gold Coast	42	Oct.-Mar.	May-Sept.	142
Brazil	15	Oct.-Jan.	June-Aug.	132
Nigeria	14	Oct.-Mar.	May-Sept.	142/160
Ivory Coast	7	Oct.-Mar.		142/155
Cameroons	4	Oct.-Mar.		142/160
San Thome	1	Oct.-Mar.		130/155
Dominican Republic	3	Apr.-Jul.	Oct.-Dec.	154
Ecuador	3	Mar.-May	Aug.-Sept.	178
Trinidad	2	Nov.-Mar.		200
Venezuela	2	Nov.-Jan.	Jul.-Aug.	154
Others	7			

The Gold Coast Colony Group

The most rapid expansion of the cocoa producing industry has been in the Gold Coast Colony. First exports from there were recorded in 1891 with a shipment of 80 pounds. In 1900, total shipments were only 450 tons. By 1934 shipments had risen to about 250,000 tons annually or about 45% of total world production. The area under cultivation on the Gold Coast covers about 1,600 square miles out of a total area for the whole territory of about 78,000 square miles. Out of a total population of about 3,500,000 natives, it is estimated that 250,000 are employed on cocoa farms.

The main crop is harvested from late October to early March. The average yield per tree is two lbs. per year and the yield per acre is estimated at 529 lbs.

The second largest producer, Brazil, also markets its crop under a form of control. Cocoa is produced on large plantations as well as small farms but, although privately produced, the crop is marketed to the United States through the Bahia Delegation.

About 39% of the world's production of raw cocoa beans is normally used by the United States, the world's largest consumer. A great part of the United States consumption is in the form of finished milk chocolate bars. Second in importance as a consumer comes Great Britain, where 16% of the world's output is consumed annually.

Cocoa beans as a recognized article of tropical agricultural commerce seldom reach this country without stones, pieces of metal, dust and other contaminations. Such material must therefore be removed before the actual processing of the raw product can start. The bags of beans are opened and one of several methods of cleaning may be applied. The beans may be sifted to eliminate the dust and fine trash, or air cleaned by blowing currents of air through a stream of falling beans, or they may be washed in water. In the latter method all stones and metals sink immediately, and the beans are removed from the water as rapidly as possible to prevent too much absorption of the water. Magnetic metals may be removed by electromagnetic cleaners either before or after washing. The method most commonly used is to screen the beans, and suck them up in a strong but regulated draft of air which sweeps the beans up and away, leaving the heavier stones and metals behind.

Roasting

The cleaned beans are then heat-treated, air-dried or steamed, the method depending upon the process used in obtaining certain desired results. The reasons for roasting are many. The shell needs to be loosened so that it may be more easily removed. The nib moisture as a rule is too high and must be reduced to permit more efficient grinding and liquefaction. The heat treatment produces a multitude of chemical changes in the raw nib material, such as a modification of the color and flavor, cooking of the protein, the evaporation of certain volatile materials such as acetic acid and water and a general reduction of natural acrid plant principles. Some of these changes may be delayed as in the case of certain special cocoas, liquors and sweet goods, for in many cases the raw beans may be dried chiefly to facilitate the removal of the shell, delaying some of the thermochemical reactions until the chocolate is

mixed and ground with sugar and reaches the conche for heat treatment.

These roasting reactions are accomplished in a number of ways, either by batch or in a continuous process. Gas, coal or oil may be used for fuel. Roasting cocoa beans by electric heat, either direct or on the radiant heat principle, has been proposed. The batch system commonly utilizes a revolving drum capable of holding 600 to 800 pounds, directly heated by gas, coal or oil. This process requires from 20 minutes to an hour, much depending upon the desired quality and degree of roasting. As a rule a battery of such roasters is operated with a semblance of continuous operation to provide supplies for the continuous winnowing process which follows roasting.

Heated air may also be used for dry roasting, usually in a continuous system. Beans fed into revolving drums may be moved counter to a current of hot air. Air temperatures of 350° to 600° F. are not unusual and the beans are roasted rapidly. Care must be taken not to burn the beans nor to scorch small pieces of broken nib, for the flavor may be adversely affected.

Various roasters utilizing superheated steam have found certain acceptance particularly in Europe. The action of dry steam loosens the shells and steam distills certain volatile acids and the cooking effect on the nib is somewhat milder than direct fire methods.

The beans leave the roasters with temperatures usually between 250° to 300° F. They should be cooled to some point below 200° F. so that the roasting reactions may be slowed up. Naturally the sooner such reactions can be checked after the proper roasting effects have been obtained, the less is the danger of over-roasting and scorching. It is even preferable to cool to below 150° F. before the beans are cleaned, for the shell and nib are more easily cracked and make a somewhat better separation when between 150° to 200° F. However, the cleaning may be made satisfactorily when the beans are around 200° F., and cooling is taking place simultaneously with the winnowing. Cooling is usually accomplished by blowing or sucking air through masses of beans in trucks or cooling bins with screen or perforated bottoms. Conveying the hot beans to the cracking rolls with cool air also serves the same purpose.

Separating the Nib

The shell of the roasted cocoa bean is quite brittle, and once broken, the whole bean usually breaks into a loose mass which needs to be separated into clean shells and clean nibs. Cracking is accomplished by passing the beans through two breaking rollers which give a mild crushing action, or by introducing the beans into a modified hammer mill or attrition mill. In certain continuous roaster systems the beans, once picked up by a strong current of air, are hurled with considerable impact against a metal plate which tends to cause them to shatter and free the shell from the nibs. In any event the mixture of broken beans is then passed through a winnowing device to effect the shell separation. The shell is hard and fibrous and lacking in high nutritive value, good chocolate flavor, and cocoa butter. It is difficult to grind and of little value as a food product.

These facts explain the reason for its separation. By classifying broken nibs and shells of approximately the same size and subjecting them to a well regulated current of air, the shell may be swept aside leaving the relatively heavier nibs to fall into the clean nib slides. The classification takes place by feeding the cracked beans into a revolving cage with perforated sections of increasingly larger openings. The shell is therefore separated leaving clean roasted nibs ready for the liquor grinding operation.

The cleaned shells are used for fertilizer. Many attempts have been made to find more profitable uses for these shells, and a number

of interesting and novel suggestions have been made.

The Art of Blending

The art of chocolate and cocoa manufacture depends greatly upon a proper blending of beans from various sources. There is no single bean, with the possible exception of Puerto Cabello, which will really result in a satisfactory chocolate by itself. Each bean has its particular characteristic flavor and aroma, and the best chocolate is made by blending beans of different flavors. Fine quality cocoas usually require special blends of beans noted for certain flavor or color characteristics. These may be mixed at this point so that the blends may be ground into liquor together. The quality of all cocoas and chocolate liquors naturally requires close attention and exacting production control from start to finish.

The natural nibs contain large percentages of cocoa butter and after fermentation, drying and roasting, there is usually more than 50% total butter fat present. The average range is 50% to 55%, depending upon the variety of bean, season of production, and other natural factors. As a general rule about 80 to 85 pounds of clean roasted nibs are obtained from 100 pounds of raw cocoa beans, about 10 to 12 pounds of clean shells, and the difference is the roasting loss, moisture and volatile acids.

The clean nibs are ready for grinding or reducing to what is commonly known as bitter chocolate or chocolate liquor. The grinding usually takes place in stone mills set in triple banks for progressive grinding, or it may be accomplished in steel roller mills, hammer mills, or in high speed disintegrating machines which tear and subdivide the cellular structure of the nib, releasing the butter to give free-flowing liquors.

This liquor may be molded into half pound or one pound bars and used directly as beverage and baking chocolate. It is usually of such fineness that 99.00% or better will pass through a 325 mesh screen, and it should always contain not less than 50% by weight of cocoa butter. Chocolate liquor is used in the manufacture of sweet chocolate and milk chocolate, and finds widespread usage in ice cream, confectionery and baked goods. It is also the immediate source of cocoa butter and of cocoa coke which, on further pulverization, gives a cocoa powder which has stronger chocolate flavor and lower butterfat.

Cocoa butter may be removed from the liquor by subjecting the liquor to high pressure in hydraulic filter presses. The liquor is filled into pots with filter screens which allow the butter to flow through with relative ease whereas the solid cocoa matter remains. The butter is collected in tanks for further filtration and clarification, and may then be molded into large blocks, or in paper lined corrugated cartons, in tin cartons for export to warm countries, or into small fingers or sticks for pharmaceutical and cosmetic uses. It is used in great quantities in the manufacture of sweet chocolates as described below.

The cake which remains in the press may have a butter content regulated to suit the purposes for which the cocoa is intended. Since 100 pounds of liquor entering the press contains about 45 pounds of cocoa solid matter, 54 pounds of cocoa butter, and 1 pound of moisture, the removal of 41 pounds of cocoa butter leaves 59 pounds of cake containing about 22% butterfat. This cake when pulverized is known as breakfast cocoa, and is packaged in half, one, and two-pound cans for direct use in beverages, syrups, confectionery and baked goods. If a so-called natural-process cocoa powder is desired, the cake is crushed, pulverized, tempered, cooled and sifted. It is then stored in cool, dry, conditioned warehouses until shipped. This is the product we know as natural-process (distinguished from "Dutch-process") cocoa powder.

All cocoas call for fine grinding, sifting and control of the butter fat. Principal tests, however, are fat analysis and screen tests. When 99.5% cocoa passes a 150 mesh screen it may be considered of satisfactory fineness for most purposes.

Sweet chocolate and sweet milk chocolates may be manufactured from the chocolate liquor by first making a mixture of sugar and chocolate liquor with or without added flavors, and thinning the mixture with cocoa butter to such a consistency that it may be fed into a roller finisher. The mixing, as a rule, takes place in what is known as a melangeur, but it may be accomplished in any type of dough mixer, or other suitable mixing and blending device. The paste is then fed into roller finishers where the paste is refined from the coarse mixture to a fine, dry paste. Additional cocoa butter reduces this paste to liquid chocolate. Once this is added it is mixed very thoroughly, using a conche or similar equipment for rubbing, kneading, blending and smoothing the paste. In this operation the chocolate is kept in vigorous motion to round off the sharp edges of the sugar crystals and produce a texture fine to the tongue as well as to the taste.

Milk chocolates are made in the same way except that dry milk powder is introduced along with the sugar and liquor. Other methods of making sweet milk chocolate are to condense fluid milk to a heavy consistency, introduce sugar and chocolate liquor, and dry the paste. After allowing a certain period of aging, the mass may be powdered and completely dried. It may then be mixed in a melangeur with more cocoa butter and ground on the finisher rolls, later to receive additional processing just as in the case of sweet chocolate.

Sweet and milk chocolate after a period of 24 to 96 hours of conching are then ready for molding into ten pound blocks, the usual size of the cakes for industrial, confectionery and baking purposes, or it may be molded into the small 5 and 10¢ bars, which we purchase at the confectionery stands. These chocolates may also be molded into various shapes such as hollow mold items, or figures of all descriptions.

Many of these chocolates are used for covering candies and nuts, and they must be adjusted to give satisfactory coverage. This work calls for specific properties requiring laboratory control of cocoa butter fat content and viscosity, as well as flavor, color, and particle fineness. The fineness and cocoa butter contents have a direct bearing on the viscosity and upon the amount of extra cocoa butter fat required for viscosity adjustment. Finer chocolates have more internal crystalline surface exposed to the cocoa butter, necessitating more cocoa butter to wet the surface if a standard viscosity is to be maintained. Thus, as a rule, the finer the chocolate, the higher is the percentage of cocoa butter needed to give a certain standard fluidity.

Certain substances have the characteristic ability to reduce the viscosity of sweet chocolates without the use of cocoa butter. One which has been widely adopted by many chocolate and confectionery manufacturers is lecithin. It is a constituent of many plant seeds and is also found in cocoa beans in small quantities. Lecithins derived from vegetable oils have been offered to the chocolate industry, and although their presence must be declared on the label to comply with the Food and Drug Act of 1938, they, nevertheless, have recognized value as viscosity stabilizers in chocolate coatings.

Imports of cocoa beans were sharply curtailed as a result of the war. Cocoa shipments from producing countries were sporadic. On Dec. 11, a government price schedule was set for cocoa beans and cocoa butter because of the rising price trend. Maximum prices for cocoa beans, ex dock, New York City, were set at 8.90¢ per lb. for F. F. Accra (main crop); 8.70¢ for Superior Bahia;

8.55¢ for Sanchez. Other varieties were also given maximum prices.

For cocoa butter, the maximum price was set at 25¢ per lb., f.o.b. factory shipping point.

It was further stated that increases in the charges prevailing prior to the opening of business on Dec. 8, 1941, for ocean freight, war risk insurance and marine insurance might be added to the maximum price only if such charges were actually incurred by the seller.

On May 12, 1942, Conservation Order M-145 was issued, restricting the volume of grindings to 70% of 1941 totals. This percentage was subject to change with conditions.

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Cocoa Beans

See Cocoa

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Cocoa Butter

See Cocoa

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Cocoanut Oil and Copra

COCOANUT OIL is one of the important vegetable fats; white to yellowish in color. When melted, it forms a colorless to brownish-yellow, somewhat greasy oil. It is obtained by pressing or expelling from copra—the dried meat of the cocoanut. It is produced domestically from imported copra and also manufactured in copra-producing countries.

Cocoanut trees grow in practically all tropical countries but the chief commercial sources for cocoanut oil normally are in the Far East—in the Philippines, Dutch East Indies, Ceylon, Federated Malay States, and British Africa.

Practically all the United States supplies of cocoanut oil came from the Philippine Islands prior to Pearl Harbor. An excise tax of 3 cents per pound was levied against cocoanut oil from the Philippines, whereas imports from other than United States possessions paid a five cent processing tax plus a two cent import duty, making a total level of seven cents.

The trees mature at seven years and die at seventy. The nuts are an all-year crop. By the time they are ripe the milk has been largely absorbed in the meats. The husk or coir is removed and the ripe nuts split. The split cocoanuts are dried in the sun or in kilns and the shell comes off easily. The meat which remains is copra.

First important step is the drying of the copra. Sun-drying produces a good quality; kiln drying may expose the kernels or copra to the smoke from the fire or even char it, causing it to yield a yellowish oil almost impossible to bleach. A more satisfactory method is to spread the meats over a lattice of bamboo sticks and draw it through a hot air tunnel. Even better results are produced in some places by rotary driers. The copra has to be dried to prevent the growth of fungi.

The oil is extracted both by hydraulic presses and by expellers, leaving a cocoanut oil cake containing from 6 to 10% of oil. This cake is sold for livestock feed.

Chemically, cocoanut oil consists principally of trilaurin, trimyrstin, triolein and the glycerides of other volatile fatty acids, including caporic, caprylic and about 10% of olein, also glycerides of lauric, myristic and capric acids. The original copra is about 63 to 70% oil.

The oil, though liquid in the tropics, is usually a solid fat in the temperate climes or in temperatures around 70° F.

In the 1939-40 season, the U. S. imported over 300 million pounds of oil, all from the Philippines; and over 500 million pounds of copra, of which better than 90 percent was from the Philippines. Principal use is in the manufacture of soap and edible oils; as a cocoa-butter substitute, and

slightly in the manufacture of plastic. It is marketed in tank cars of approximately 60,000 pounds capacity and in drums of about 400 pounds. A price ceiling on crude oil of $8.325 per hundred pounds was fixed on Dec. 13, 1941. Imported oils come in steamship's deep tanks, in bulk, while continental transportation is by drum, tank wagon, and railroad tank car. If stored in bulk and not heated or otherwise disturbed, it will remain practically unchanged in quality for several years. Crude and refined are two general grades but there are many variations of each. Refined oil usually sells at a premium of 1¢ per pound over crude, but grades depend upon the industry in which it is to be consumed. About the best known substitute is Babassu Oil which comes principally from Brazil.

Cocoanut Oil is extremely important to the war effort. This oil contains more glycerine than almost any other vegetable oil. As stated before, the oil is also used in making soap, as well as various edible fat products.

The war has seriously interfered with this business, inasmuch as almost the entire amount of Cocoanut Oil consumed in this country originated before the war in the Philippine Islands. The sources of supply have now been completely cut off, and the country has been forced to turn to outside markets as well as substitutes.

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Cocoanuts

See Cocoanut Oil

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Cocobolo

Cocobolo is the reddish, yellow wood of a hardwood tree that grows in Central America and comes in commercial quantities from Nicaragua, Panama and Costa Rica. It is extremely hard and very heavy, the weight being 75 to 85 lbs. per cubic foot. Our annual imports amount to from 1,000 to 2,000 tons per year. Uses are in kitchen cutlery handles, tool handles, hair brush blocks and wooden novelties. This wood is marketed by weight in log form, either by the pound or gross ton. When converted into lumber or veneers, it is sold by the foot. Some concerns are reported using light weight domestic wood, stained dark to resemble cocobolo, as a substitute. However, since cocobolo weighs 7 pounds to the board foot and domestic wood weighs about 3½ pounds to the board foot, it is impossible to substitute the weight. There is no duty on cocobolo logs.

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Cod

See Codfish

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Codfish

The codfish is of the family of Gadidae, all of which have a general resemblance to the common codfish known as Gadus callarias (Linnaeus). The Alaska cod, Gadus macrocephalus, is very abundant from Cape Flattery to Hakodate in Japan, particularly around the Aleutian Islands and the Okhotsk Sea, and differs but little from the Atlantic codfish.

Cod is considered one of the most important fish of New England and much of that area's early prosperity can be attributed to the cod. Cod was the basis upon which many fortunes were made contributing largely to the early financing of New England's great industrial centers and factories. So important do they consider the cod in Massachusetts that a wooden replica of a codfish hangs in the State House at Boston and is known as "the sacred cod." Some of the first families of that state are often referred to as "codfish aristocracy".

The cod is easily recognized by its rather heavy body; by the three fins on its back and

two below its tail which are composed of soft rays only; by its nearly square tail; by the location of its ventral fins; and by its single short whisker or barbel, at the tip of the lower jaw.

The color of the cod varies all the way from gray to red, and the upper parts are nearly always spotted with reddish brown and sometimes yellow. The lateral line is pale, never black.

The cod, like the haddock, is very prolific. A large female may often have as many as nine million eggs in one spawning.

Cod are caught in shallow waters as well as out in water as deep as 100 fathoms. It is both an off-shore and an in-shore fish.

Cod are caught mostly by trawl nets. A large number are also caught by line trawls (hook and line, a number of hooks attached to an anchored line that might be a mile in length).

Cod is marketed mostly in three sizes: Large, Market and Scrod. Standards are: Extra large, over 25 pounds; large 10-25 pounds, inclusive; Market, over $2\frac{1}{2}$ to 10 pounds; Scrod, $1\frac{1}{2}$ to $2\frac{1}{2}$, inclusive.

Cod is marketed both in the round and dressed, fresh and frozen. They are also marketed as fillets, sticks and steaks, fresh and frozen packaged. Cod is also sold, both round and filleted, as smoked and salted product. It is also pickled. Cod tongues and cheeks find a good market. Cod livers have taken on a new value due to the drop in importations of cod liver oil.

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Cod-Liver Oil

See Fish Liver Oils

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Coffee

THE United States, during peace or war, consumes more coffee than the rest of the world combined. When the war caused European markets to be shut off from usual sources of supply, this country was virtually the only market left for the coffee-producing countries of the world.

Coffee is the pit or seed of the ripe fruit of the coffee tree. The cherry, somewhat larger than the ordinary cherry, has a purplish red hue. It is prepared for market by the elimination of the soft, sticky mucous outer covering; plus drying, grading and the elimination of foreign matter such as sticks, stones, bad beans, etc.

There are about four billion coffee trees spread throughout the world, nearly 75 percent of them in Brazil. Each tree yields only slightly more than a pound of green coffee beans annually, although the yield-per-tree varies greatly with the country, the age of the tree, and the weather during the growing seasons.

The coffee tree, or bush, takes from five to six years of growth before producing a commercial crop and flourishes best in subtropical climates at altitudes varying from a few hundred feet to five or six thousand feet, and where frosts are rare. As with many fruit crops, bumper yields are often followed by small crops as the trees take time out for recovery. After about fifteen years the trees produce less and less until it becomes uneconomical to continue them in production. Then, too, vagaries of weather—drought, frost, high winds, excessive rain, all have their effect on the crops.

Coffee is produced in over forty countries of the world but Brazil and Colombia together produce four-fifths of the world's needs. Coffees of the Western Hemisphere supply 98% of the United States consumption and this country even in peace times, used as much as the rest of the world combined.

Under the Inter-American Coffee Agreement, signed by fourteen Latin-American producing nations and the United States in November, 1940, and made retroactive to October 1st, 1940, to run for a three year

period, quotas are set up on imports into the United States. The basic grand total is 15,900,000 bags of 132 pounds (60 kilos). Brazil can supply 9,300,00 bags or 58.49%; Colombia 3,150,000 bags or 18.81%; El Salvador 600,000 bags or 3,77%; Guatemala 535,000 bags or 3.36%; Mexico 475,000 bags or 2.99½; Venezuela 420,000 bags or 2.64%; Haiti 275,000 bags or 1.73%; Costa Rica 200,000 bags or 1.26%; Nicaragua 195,000 bags or 1.23½; Ecuador 150,000 bags or .94%; Dominican Republic 120,000 bags or .75%; Cuba 80,000 bags or .50%; Peru 25,000 bags or .16½; and Honduras 20,000 bags or .13%. In addition 355,000 bags, or 2.23%, can come from all non-signatory countries which includes the "Colonial" producers of Africa and Asia.

The Inter-American Agreement, administered by a "Board" consisting of one delegate from each signatory country, has functioned well since its inception. The Board has promptly adjusted quotas to conditions and has acted promptly on other problems coming within its jurisdiction. A recommendation by the Board for the continuance of the Agreement must be made by October 1, 1942 or one year prior to the terminating date. A continuation of the agreement—with probable amendments—is expected.

Generally speaking, world coffees fall into two common groups. First is the "high" quality which includes "mild" coffee, the produce of the "Arabica" variety of Colombia and of other Central and South American countries. Arabian coffee and some of British East Africa and Belgian Congo's crop would fall in this group, as well as the "soft" coffees of Brazil. There is also the "low" quality, low-priced type of coffee. These include the "hard" Brazilian grades, Rios, Victorias, etc., and the three million-odd bags of Robusta, Surinam and Liberian varieties produced mostly in the Eastern Hemisphere.

In the final analysis it is "the drink that counts" and coffee of beautiful appearance may taste otherwise. The human senses still serve better than any chemical test in determining the quality of a certain few commodities and coffee is in that group.

All Brazilian coffee is packed in bags of 60 kilos or 132 pounds while the Colombian coffee bag weighs 70 kilos or 154 pounds. Other standards are customary in other producing areas. However, more and more, statistics are being compiled on the basis of 132 pounds and where different units are involved, figures are often converted to that common basis.

Because of the long ocean trip from Brazil to the United States, freight rates are an important factor in the coffee market. Usually an advance in the freight rate will bring an advance in the landed price. The normal trip from Brazil to New York takes two to three weeks.

Brazilian coffee is sold to the United States, generally on what is known as a "cost and freight" basis. This applies except where American roasters have offices in Brazilian ports of export and do most of there buying there. Brokers in this country for Brazilian exporting firms receive regular cables quoting various lots of coffee for sale and export. Prices are quoted in American money per pound with a description of the coffee and the size of the "lot" or "chop" as well as the period during which it will be shipped. Some contracts contain a clause which makes the buyer responsible for any change in freight rates before shipment is made or freight space arranged and in some instances buyers are forced to arrange their own freight space.

In general practice these offers are either accepted by roasters from agents, acting only as such, or offers are taken by importers who will in turn later resell this coffee to roasters. Payment is usually arranged on a 90-day confirmed letter of credit against bill of lading certifying that the coffee is on the way here. All insurance of the coffee while afloat is covered by the buyer who also pays the freight

and deducts it from his final payment to the seller. Thus an offer, accepted on a cost and freight basis, is subject to the added cost of insurance while afloat and this inclusive price plus landing charges, represents coffee in warehouses in this country.

The term "prompt" shipment, as applied to Brazil, means shipments within 30 days of the date of sale, the particular steamer usually to be at the option of the seller. Very little coffee leaves Brazil unsold either for resale while afloat or on consignment to an agent here. During recent years a good deal of coffee has been sold on a "forward shipment" basis. In many cases this has been for "even monthly shipment Jan.-June" or often for even monthly shipments over a period of a full year, termed " 'round the clock" sales. The new coffee agreement will naturally curtail much of this forward business, unless the authorities will accept such sales "officially" and count them against the export quotas involved.

The "jobbing" of coffee, by importers and other brokers here includes in the inclusive sense all resales. This is usually done by sample, and the coffee is almost always either in warehouse or temporarily on docks pending sale. Interested buyers, or their agents, are submitted samples to examine and cup test or in many cases do their own searching for the coffee they want. Sales of this type run anywhere from a single bag to substantial quantities. In this manner the small roaster, unable usually to handle shipment lots and for that matter sometimes not interested in a large volume of one specific type, is in a position to acquire just the coffee he needs in his blend from the stocks carried for that purpose by importers.

An important change in the marketing of coffee has taken place here during the last two decades. National distribution has sifted into fewer hands as more roasters have adopted the method of direct purchases through agents from primary countries to the detriment of the business of importing and jobbing coffee.

At the same time even the largest roaster finds it necessary to acquire supplemental stocks from importers here from time to time and many roasters would rather depend on the good judgment of importers for the particular coffees they want than take a chance on a direct purchase.

As in other lines of business, offers from Brazil are subject to interpretation depending on the "name" of the exporting firm. Coffee—bought solely on description—described in exactly the same language, may be slightly apart in price at a given moment. The prospective buyers, when accepting various offers, consequently weigh in their minds the reputation of the shipper, the coffee usually handled by that exporter, and other important pertinent facts.

Most cost and freight contracts are subject to arbitration by the Green Coffee Association of the port of entry. In New York, the association on demand will arbitrate a dispute regarding any contract and adjustments are made by the exporter if it is found that the coffee involved is not up to the description made in the contract. Thus selling on a cabled description rather than on sample is the accepted mode.

Most of the coffee entering the United States comes directly to piers adjacent to public warehouses in New York and New Orleans, but the other ports, i.e., San Francisco, Boston, Norfolk, Philadelphia, Houston (through Galveston), Jacksonville and, lately, Savannah and Charleston, are credited with over a million bags combined, each year.

During recent years, the steamship lines, by agreement have allowed ten days "free time" on docks after which the coffee either has to be moved into warehouses or a charge made for excess time on piers. Recently this "free time" was reduced to six days, exclusive of Sundays or holidays.

Coffee when unloaded from ship is in a

jumbled state and must be sorted into "marks" and "chops" on the pier. As the stevedores pick up the bags to move them to their proper place they pass before a checker who indicates in what pile the coffee should be placed. Chalk marks on the pier floor and often flags are used in order to keep the coffee moving from the ship to the dock in an orderly manner.

Coffee warehousing is an important business. The coffee must be kept dry and free from contaminating odors. Warehousemen, as a part of their service mend torn bags, and take all other necessary steps to insure the safe keeping of the coffee. They are often called upon to insure that all coffee of one specific mark is uniform and where it is otherwise, are required to "dump and mix" so that any sample taken will be a true sample of the entire lot. Certain damage to the coffee in transport is also detected through warehouse inspection. Licensed weighers check the weight of all coffee over a beam scale and these weights are accepted by buyers and sellers. In the same manner licensed samplers make a living taking samples of coffee to be used in grading or selling a particular lot. Warehousemen require a written sampling order from the owner of the coffee before permitting a sampler to take his customary three or five pound batch of coffee, from several bags at random, a true sample of the entire lot.

Ownership of coffee in warehouse and liability for the storage charges, is evidenced by what is known as a negotiable warehouse receipt. "Negotiable" because ownership is transferred by endorsement of the holder which is honored by the warehouse company and a new certificate issued.

All coffee enters the United States free of duty, but most producing areas are now applying export taxes to help finance their coffee programs. The customs inspectors must be sure that coffee meets a minimum standard fixed by the Government, not lower than type 8 and in sound condition. In addition, under the obligations of the Inter-American Agreement, the customs offices are now used also to count entries "for consumption" against the quotas fixed by that pact.

Roasters

Coffee has only one use in this country—that of beverage. However, Brazil will soon operate a plant which will produce plastics from coffee (cafelite) and at the same time derive caffeine, oils and other materials from the beans. The capacity of this factory is 50,000 bags annually and it is hoped a new industry will eventually result from this initial experiment.

There are about one thousand coffee roasters, large and small, in the United States. They are represented by the National Coffee Association which includes most important processors among its members. The roasting of coffee, in its simplest terms, is the applying of the proper amount of heat to the green coffee beans, while keeping them agitated to prevent burning and insure even roasting. The loss of weight in the roasting process, which removes the outer skin called "chaff" and of course takes further moisture from the bean, amounts to about 19%.

Industry Cooperation

The Inter-American Agreement, afore-mentioned, is the first pact of truly international scope ever concluded among coffee producing countries. While Brazil for many years has attempted, alone, to take care of the "surplus" problem, it took the war, the good offices of the U. S. State Department, and new all-time low prices, to bring about a cooperative agreement.

The agreement is designed "to promote orderly marketing of coffee with a view to assuring terms of trade equitable for both producers and consumers by adjusting the supply to demand." Quotas are a part of

the pact in order that each country receives its fair share of the United States market. The authority to administer the pact is given to an Inter-American Coffee Board consisting of one delegate from each signatory country. Fourteen Latin-American countries and the United States are parties to the agreement. In order to insure a sufficient supply for the United States, this country's lone vote is sufficient to lift quotas without limit in any "emergency."

Coffee consumption in the United States has shown a marked increase during the last three years. This is attributed mostly to the efforts of the Pan American Coffee Bureau. This bureau, supported by eight Latin-American producing nations, and with the full cooperation of the National Coffee Association, has been conducting a nation-wide campaign in the interests of an increased consumption. This theme has been a "better-brew" and the dissipation of false rumors and impressions regarding the harmful effect of coffee drunk in moderation. Member countries are: Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, El Salvador, Mexico and Venezuela.

Since December 1941, maximum prices for green coffee have been fixed by OPA's Price Schedule No. 50, under which Brazilian Santos 4s are priced at 13⅜¢ per pound, and other growths and grades of coffee at premiums or discounts. Originally, the price schedule permitted the addition of increased rates of marine freight, war risk, etc., above the rates in effect on Dec. 6th, 1941, but recently the absorption of war and marine insurance by the CCC has negated this feature of the price regulations. On April 28, 1942, by WPB Order M-135, restrictions were placed on the amount of coffee which roasters could deliver and "wholesale receivers" receive. The initial percentage was fixed at 75 per cent of 1941 performance, reduced to 65% beginning Sept. 1, 1942. In addition, roasters were restricted to two months supply of green coffee and were forced to offer for sale any new coffee arriving which would bring their inventory above the "allowable" total. Under M-63, as amended, effective July 2, 1942, coffee importers must secure permission for purchases and import and have been assigned quantity quotas based on their business in 1940-41.

Shipping, especially from Brazil, has not been equal to the task of bringing sufficient coffee here for normal needs. The quotas established by the Inter-American Coffee Board were raised in July, 1942, to enable the use for consumption of all coffee which can get to this country.

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Coke

COKE is coal which has been "baked" in ovens to drive off the volatile materials. It is produced in two general types of ovens, the by-product oven which permits the use of the volatile material in by-product recovery, and the bee-hive type oven which does not lend itself to by-product recovery.

By-product coke ovens consist of large rectangular chambers, which are heated by burning gas in adjoining flues. Only about 8% of the heat of the coal is required to carry out the process, which recovers all of the volatile products. The fuel gas may be a part of the coal gas obtained, or else producer gas made from the small coke.

By-product coke ovens were introduced from Europe nearly fifty years ago, primarily to obtain ammonia for use in the manufacture of soda. The yield of ammonia was only 0.3% by weight of the coal, and markets had to be found for the coke, gas, tar, benzol and other products. Additional plants were built for various reasons, and eventually the first World War greatly stimulated the demand and prices for coke and by-products and caused a great expansion of the industry. The largest

number of by-product coke ovens are at iron and steel plants, but numerous by-product coke ovens have also been built at city gas plants. The resulting coal gas is used to supply the base load, while additional carburetted water gas is manufactured as needed from part of the coke and purchased oil. A by-product coke plant represents a large investment, requires skilled personnel for operation, and cannot be shut down without heavy expense and considerable injury to the ovens, which are constructed of silica brick.

Most coke today is produced in by-product ovens. Of the total production in 1941, by-product ovens accounted for about 90 percent and beehive ovens the balance.

The most valuable by-product sold is gas, followed by light oil and its derivatives. Considering only by-products sold, it is true that light oil and derivatives rank second but the value of tar produced is greater than that of light oils and derivatives, because about one-half the tar is not sold but is used as a fuel in the steel plant. Toluol, a derivative of light oil, is an important ingredient in the production of explosives. Benzol which is about 65% of the light oil, has been extensively used as a motor fuel in normal times but today this use is prohibited by the Government since benzol is desperately needed for synthetic rubber, explosives, etc. Ammonia, another coke by-product, also is used in the manufacture of explosives. Ammonia goes into the production of ammonium sulfate, used in the fertilizer industry. Miscellaneous products constitute the other important by-product groups of the coke industry.

Coke was originally manufactured in hemispherical ovens made of fireclay brick, which were known as beehive ovens because of their shape. In the beehive oven, the coal is charged in a thick layer on the floor of the oven and allowed to burn with a limited supply of air. About 33% of the heating value of the coal is consumed in the process, including all of the coal gas and tar, and some of the coke. For this reason, beehive ovens are located close to the coal mines. Because of the low capital investment and the fact that they can be readily started up or put out of operation, beehive ovens are still used to meet the peak loads of the coke industry. They are also used to produce a very large coke that is favored by foundries.

While by-product ovens are located in many areas throughout the country, most of the beehive coke is produced in the region around Connellsville, Pennsylvania.

Coke production in 1941 totaled 64,765,000 tons, of which 6,352,000 tons were bee-hive coke and 58,413,000 were by-product coke. Those total production figures included coke produced by companies in ovens not operated by the steel industry.

By far the largest amount of coke is used in blast furnaces, but most of this is produced by the iron and steel plants or their affiliates, and does not become a commodity on the open market.

The next largest market is domestic coke for house heating. Foundry coke is a premium-priced product, but the market consumes very little of this type. A couple of million tons of coke are sold or used by the producer for the manufacture of water gas and producer gas, and a similar amount is required for miscellaneous industrial purposes. Coke screenings or breeze amount to 2 to 5 million tons, and are used principally for raising steam.

It is generally sold on a net ton basis. Current prices for Connellsville coke are $6.00 per ton (F.O.B. oven). The price of bee-hive coke delivered at Chicago, one of the most important consuming areas, is $12.25 per ton.

Maximum by-product coke prices were established by the OPA and became effective October 1, 1941. The maximum prices for bee-hive coke for blast furnace use were established by the same agency on January 6, 1942.

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Cold Molding Compounds

See Plastics

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Columbite

See Columbium

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Columbium

CALLED Niobium in Europe (Nb), Columbium is an elementary metal (Cb) which is allied with tantalum and often difficult to separate. Both columbium and tantalum are used directly and indirectly in the manufacture of munitions and the war has expanded the demand. It occurs in the minerals columbite and tantalite. The specific gravity of the metal is 8.33 and the melting point about 2500° C. It is ductile, malleable, insoluble in most acids and resistant to most acid salts. It is capable of absorbing gases at high temperatures, as tantalum does. Its chief use is in the production of ferrocolumbium, used in the production of a stainless steel which withstands high temperatures.

World production of tantalum and columbium ores rose from about 6 tons in 1930 to 200 tons in 1934 and probably to about 750 tons annually in 1938 and 1939. Later figures are, of course, not available. Total United States imports of tantalum ores in 1940 reached 490,460 pounds against 56,561 pounds in 1939 which was a record up until then. Ores from the Belgian Congo and other African sources and from Brazil came to the United States instead of to the usual European buyers. Such ores contained more Columbium than those from Australia. Imports of Columbium ore, including small quantities from countries other than Nigeria, rose to 595,220 pounds in 1940—more than five times the imports of 1939. Ferrocolumbium, being cheaper than ferrotantalum, has replaced the latter in many uses.

Domestic ores are mixtures of columbite and tantalite as, in fact, are almost all ores except the columbite produced in Nigeria and the tantalite produced in Wodgina, Australia. Materials most sought after, according to experts, are columbite with a small tantalum content and tantalite with a small columbium content rather than ores with about equal content of each metal. It is also deemed important that the ore be free from cassiterite and wolframite.

In June, 1942, ferrocolumbium was priced at $2.25 per pound of Columbium content in ton-contract lots; at $2.30 in less than ton lots.

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Concrete

PORTLAND CEMENT CONCRETE is a mixture of portland cement, water, sand and suitable materials such as gravel, crushed stone, slag and others less commonly used. This combination is a plastic material when first made but it hardens within a few hours into a stone-like substance of considerable strength which increases with age. These characteristics make it adaptable to an almost limitless range of structural and product uses.

Reinforced concrete, a most versatile and enduring structural material, in principle may be traced back to 90 years ago when a Frenchman built flower pots with embedded wire frames. Out of this basic construction procedure he has evolved the present method of combining the compressive strength of concrete and the tensile strength of steel.

Soil-cement construction, which should not be confused with the above-described portland cement concrete, is the combining of natural roadway soil with portland cement and water to produce a durable, weather-resisting material for low-cost, light-traffic highways, secondary airport runways and parking areas.

(See Cement.)

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Copolymers

See Polyvinyl Ester Resins

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Copper

BECAUSE copper and its alloys are so essential in the war production program, these metals are under strict control. The alloy, brass, because of its ductility and resistance to corrosion, is the preferred metal for shells and cases. Copper and brass are also employed for various other munitions items. These metals are also of the greatest importance to the Navy for their numerous marine usages. Also, with communication a vital factor in war, and because radio and wire communication involve the extensive use of copper, the use of this metal becomes a factor of major importance in the full war program.

The two principal methods of mining copper from the earth are by underground mining and open cut mining.

In underground mining, shafts go down into the earth in some cases to a depth of over a mile. Men and supplies are handled in cages and the ore is hoisted in special skips. After hoisting, the ore is crushed and sent to the concentrating mill, where gangue or waste is separated. The most common type of copper occurrence is in sulphide ores, where the copper is combined with iron and sulphur. Sometimes the copper occurs as oxidized ores which result from the action of the atmosphere on original sulphide ores. This type of ore is treated by a leaching process instead of by concentrating.

Open cut mining is used where ore deposits occur near the surface. Mining operations consist in cutting benches into the ground where huge electric shovels remove the broken material after blasting. The largest open cut copper mine in the United States is located in Utah — a mountain two and a half miles long and half mile high, where copper is being extracted profitably from a low copper-content ore known as "phorphyry". This class of ore frequently contains less than 1½% of copper but it is one of the most important sources of copper today.

Principal producing states are Arizona, Utah, Montana, Nevada, New Mexico and Michigan. The 1939 figures of the American Bureau of Metal Statistics gave U. S. production as 734,990 tons out of a total world production of 2,382,641 tons. The second largest producer in that year was Chile with 373,870 tons. Canada was third with 310,257 tons. Fourth was the Belgian Congo (Africa) with 133,929 tons and Russia was fifth with 118,000 tons. Japan ranked sixth with 84,900 tons.

After ore leaves the mine it is treated in various ways to separate the metal from the other minerals. If the ore is low grade in copper, it is concentrated in order to eliminate a large part of the lighter minerals. In this process the ore is crushed and then ground to a pulp of fine particles. This pulp is mixed with very small amounts of oil and chemical reagents and then sent to long box-like machines where the solution is agitated so as to form a froth of bubbles on top. The metal particles remain in the froth and are floated off, dried and loaded into railroad cars. This material is known as concentrates.

Concentrates and high grade ores are treated by a smelting process to recover the copper in metallic form. Usually the material is roasted in specially constructed multiple hearth furnaces to eliminate excess sulphur. The main process consists in melting the charge in long, flat reverberatory furnaces where the lighter constituents flow off from the top of the molten material in the form of slag. The heavy metals including mostly copper and iron are drawn off intermittently in an impure form known as matte and sent to converters. These are large barrel-shaped vessels. Compressed air is blown in through valves and also some silica added. The other constituents are elim-

inated as oxides and silicates, leaving blister copper which is cast into cakes, or anodes for shipment to the electrolytic refinery.

When the copper leaves the smelter it is over 99% pure, but does contain minute quantities of gold, silver and other substances. Some of these act as impurities when copper is used to conduct electricity. From the smelter copper is usually sent to a refining plant. Here it is melted and cast into plates called anodes which are suspended in long tanks containing a solution of copper sulphate and sulphuric acid. By an electric current anodes are gradually dissolved in the solution and the copper redeposited on a series of plates called cathodes. The cathodes are practically pure copper and in most cases are melted in a furnace and cast into wire bars or ingots, or other shapes convenient for fabrication before being shipped.

Refined copper is the basis of a great many industries, such as copper rolling mills, wire drawing mills, tube mills, and the manufacture of brass and other alloys. Accordingly, special shapes of refined copper are prepared for specific industries. For example, where copper has to be remelted in crucibles either for the making of copper castings or for the manufacture of alloys such as brass, bronze, nickel-silver and so forth, the refined copper is delivered in ingot form, of a shape that will readily fit into crucibles. The ingots are about 10 inches long, weighing about 20 pounds. Ingot bars are often used to facilitate shipping and handling in large quantities. An ingot bar may be considered as two or more ingots in one bar, which, owing to deep notches, are readily broken apart.

Wire bars, the most popular form of refined copper bars, are used by wire mills for the drawing of copper wire. These bars are generally cast with pointed ends to facilitate the bar entering the first set of rolls. The size and weight of bars vary somewhat but their dimensions and weights are being standardized. The 220 to 225 pound bar, 54 inches long, is the size most commonly used.

Slabs and square cakes of various sizes are used for rolling purposes, where sheet copper strips or bus bars are the final products. The sizes of these vary greatly, depending on the sizes of the finished product required. Circular cakes are used for the manufacture of large, seamless, cylindrical products such as kettles, tanks and other vessels.

Billets are used for the manufacture of seamless copper tube of all sizes. Billets vary from 2 to 6 inches in diameter, up to 52 inches in length, and up to 1,600 pounds in weight.

About 40 per cent of the copper used in this country goes into the electrical industry. Copper also is essential in the modern communication system through its use in millions of miles of telephone and telegraph wires. Railroads and ships are also heavy users.

Important peace-time uses for the fabricated copper and alloy products are in the automobile, building, air-conditioning, radio and mechanical refrigeration industres. Also, the light and power industries and similar fields consume large quantities in various forms.

Of all the copper alloys, brass is the most common and generally used. This alloy is a mixture of copper and zinc but no standard rule governs the proportion of these metals except that copper must be dominant.

Bronze is a mixture of copper and tin and by the varying of the quantities of copper and tin, the qualities of bronze may be greatly changed. The percentage of copper used is seldom less than 80 per cent.

During 1941, increasing amounts of copper were diverted to military uses and this trend was intensified in 1942. The supply situation became so tight that most copper in 1942 was used for military purposes with a relatively small proportion allotted to the most essential civilian requirements. Beginning May 29th, 1941, the delivery of the

copper supply was placed under Government control under order M-9. This gave way to order M-9-a on August 2, 1941 and was later amended January 7, February 6 and 25 and May 7, 1942. Brass mills, wire mills and foundries were required to limit shipments of all products to A-1-k ratings or higher. Order M-9-c eliminated the use of copper and its alloys as of January 1, 1942 in more than 100 civilian items and the amendment of May 7 prohibited the use in an additional 100 items after June 15.

Prices are quoted in cents per pound. Price Schedule 15 as amended August 28, 1941 placed a ceiling of 12 cents per pound, Connecticut Valley, electrolytic, in carlots. The ceiling f.o.b. refinery for casting copper in carlots was 11.75 cents. The OPA also announced a plan providing for the payment of 17 cents to producers who exceed given quotas.

The duty is 4 cents per pound.

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Copper Carbonate

COPPER CARBONATE chemically is cupric carbonate, or basic copper carbonate. It is a green, sometimes bluish powder, insoluble in water, but soluble in acids and ammonia solutions. It is produced by adding a solution of a carbonate, such as sodium carbonate, to a soluble cupric salt, as copper sulfate (blue vitriol). The insoluble basic carbonate precipitates out, is filtered off, and dried.

Commercially, grades of copper carbonate containing 18 to 20 per cent and 52 to 54 per cent of cupric oxide are available. Production of copper carbonate in 1939 amounted to 605,101 pounds, valued at $96,-229. Five plants were in production during the year. In 1937, six plants manufactured 814,163 pounds of the material, valued at $121,776. It is packed in 250 and 400-pound barrels; 100-pound kegs; 25-pound boxes; and one and 5-pound bottles.

Copper carbonate is used as a pigment, in the manufacture of other copper salts, in insecticides, and in fireworks. On June 1, 1942 and January 1, 1942 the price of the 52-54 per cent copper carbonate was 18¢ per pound. At the start of 1941, the same material sold for 16½¢ per pound.

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Copper Cyanide

THE copper cyanide of commerce is cuprous cyanide chemically. It is a creamy powder formed by the reaction of potassium cyanide with a soluble copper salt, such as copper sulfate. Cupric cyanide precipitates as the reaction proceeds, but upon drying, the cupric salt decomposes with the evolution of cyanogen, leaving cuprous cyanide. The powder is exceedingly poisonous. It is insoluble in water, but dissolves in muriatic acid, ammonia, and potassium cyanide solutions.

Four plants in the United States have been producing copper cyanide commercially in recent years. During 1939 production amounted to 889,721 pounds, valued at $297,712. In 1937, 738,683 pounds, valued at $264,244, were produced. Copper cyanide is packed in kegs and wooden barrels ranging from 100 to 300 pounds in weight, and in 25-pound fiber drums.

The largest use of copper cyanide is in electroplating. It also is employed in chemical practice to supply the cyanide group in the production of aromatic organic compounds. For the past two years technical copper cyanide has been quoted at 34¢ per pound.

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Copra

See Cocoanut Oil

Cordovan

See Horsehides

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Cork

CORK is the outer bark of two species of evergreen oak trees — Quercus Suber and Quercus Occidentalis. It is made up of millions of tiny air-filled cells held together with a natural gum or resin. The cell walls are thin but very strong. Fifty-three per cent of the total cork volume is air, which accounts for its lightness. This unique cellular structure also explains the resilience of cork and its compressibility, its resistance to decay, its low absorption of liquids and its property of resisting the passage of heat. The cork bark is stripped from the cork oak trees for the first time when they are about twenty-five years old. The average productive life of a tree is one hundred years, and during that time it may be stripped every nine years. The trees flourish in Portugal, Spain, northern Africa, southern France and the western islands of the Mediterranean. Normal world production is estimated at about 270,000 metric tons. Portugal produces 45-50% of the total; Spain 20-25%; North Africa, 20-25%; others (Italy, Corsica, Sardinia, Sicily) 5-10%.

Uses include corkboard and cork covering for low temperature insulation; cork composition for sheets and gaskets; cork bottle stoppers; cork liners for bottle caps; cork units for acoustical purposes; cork flour in certain types of linoleum, etc. Cork is marketed by the cargo and priced by the ton. Milling cork has ranged from $65.00 to $120 per ton abroad, depending on the grade while corkwood prices have ranged from $100 to $600, depending on grade, and grinding cork, $45 to $70. Ocean freight rates and changes due to war conditions, have brought a wide advance in landed prices. Corkwood is used principally for natural cork stoppers, liners for bottle caps, handles, floats and other natural cork specialties; milling cork is ground to produce composition products such as gaskets, crown cap liners, etc., while grinding cork is used for cork insulation, pipe coverings, etc. There is no import duty on raw cork.

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Corn

CORN is the most important crop grown in in the United States, measured either by acreage or by value to the American farmer. It is the leading feed grain of the country and constitutes the basic raw material for the livestock and allied industries. It has a far reaching effect upon the production and price of such items as meats, provisions, lard, poultry, eggs and dairy products.

The United States is the leading producing nation, accounting for more than half of the world's output. Over a period of time it was discovered that corn could be produced more advantageously in an area including parts of Ohio, Indiana, Illinois, Minnesota, Iowa, Nebraska, Missouri, Kansas, South Dakota and Michigan, where production became highly concentrated. This is the "Corn Belt." While corn is grown in practically every state in the Union, more than 60 per cent is produced in the area defined above.

Since corn is grown mainly for feeding purposes, the corn belt is also the center of a large animal population. A few areas near the important market places grow corn to be sold primarily as grain, but elsewhere the hogs are brought to the corn. Iowa, largest corn producing state, also raises the highest number of hogs. The states mentioned above raise more than 50% of the nation's hogs and 30% of the cattle. They also produce a large number of chickens and most of the country's eggs.

The planting season in corn varies with lo-

cation. In the southern parts of Texas the crop is seeded during the late winter months and planting gradually spreads northward during the spring. Planting becomes general in the major sections of the corn belt in May and is usually completed by June. The average growing season in most of the belt ranges from five to six months, although it may be longer or shorter in other sections of the country.

Moisture and temperature are the chief factors in governing yields. Moisture must be spread fairly evenly over the months. Rainfall and moderate temperatures during July are especially important. Drought and very high temperatures for any sustained period in July often bring crop scares. Drought and heat in 1934 and 1936 cut the crop almost in half.

Late spring or early frosts have caused crop damages, especially in the northern producing areas, where they reduced the length of the growing season. Early fall frosts are especially damaging to corn which has been planted late, often impairing both quantity and quality. The length of the growing season is an important factor in production.

Other causes of damage are plant diseases such as smut and root, stalk, and ear-rots. Among the principal insect pests are the chinch bugs and the corn-ear worm. Chinch bugs have been most injurious in seasons of inadequate moisture. Occasional damage also is caused by grasshoppers. These pests have been especially harmful in the areas west of the Mississippi.

Owing to the vagaries of the weather, production often fluctuates violently. Since World War I, output has ranged from 1.1 billion bushels in 1934 to 3 billion bushels in 1942.

More than 80 per cent of the domestic corn crop is consumed on the farm as a feed for livestock. The most important consumer is the hog, followed by horses and mules, cattle, poultry and sheep.

Commercial uses for corn are numerous. Among its most important products are corn starch, corn sugar, corn syrup, dextrines, corn oil, gluten feed and meal. The production of corn oil has increased substantially in recent years. Corn is used in the production of whiskey and industrial alcohol; also in the making of chemicals. Corn meal, hominy, and breakfast foods are among other products derived from corn. Numerous types of poultry feed are made from corn. Since the advent of war, an increasing amount of corn has been used for industrial alcohol and ultimately for the production of smokeless powder and other military uses.

The processing of corn for starch and its derivative products is an industry distinct from all other activities that use American corn. The industry calls itself the Corn Refining Industry but is also known as the wet-milling industry because the corn is wet when ground and water is used as the suspension medium during most of the other processes. The basic products of the industry are corn starches, corn syrups (both liquid and dried), dextrins and corn sugars (both crude and refined). The principal by-products are corn oil and feeds.

The marketing unit of corn is the bushel. The price early in September, 1942 was 84 cents per bushel of No. 2 yellow in Chicago. Corn is transported by truck, rail and boat.

The principal grades are Yellow Corn (Nos. 1, 2 and 3), White Corn (Nos. 1, 2 and 3) and Mixed Corn. Substitutes consist of other grains. The duty on corn is 25 cents per bushel (10 cents, Canada).

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Corn Oil

CORN OIL is a pure vegetable oil expelled from crushed corn germs. About one and a half pounds of corn oil are extracted from each bushel of corn processed for its starch, the oil being a by-product. About 170 million pounds of corn oil are produced in

the United States annually, in corn mills scattered throughout the middle west corn belt. About 130 million pounds are marketed each year as refined corn oil and the remainder as crude corn oil and a soap stock. The "refined" product goes mostly to the food industry principally for the manufacture of mayonnaise and salad dressing, and also as salad and cooking oils. A smaller amount is used industrially by the soap industry for artificial leather, artificial rubber, oil cloth, packaging and paint and varnish. The oil is quoted by the pound. Government ceilings were fixed, recently, at $12.75 per 100 pounds for crude oil in tank cars f.o.b. mill, while refined oil's ceiling was $14.25 in tank cars f.o.b. Chicago. It is shipped in tank cars, drums and small cans. Its stability is in line with that of cotton oil and other salad and cooking oils used for general food purposes. It is interchangeable in most uses with cottonseed oil, soybean oil, and peanut oils. There is no import duty.

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Cornstarch

CORNSTARCH is one of the basic products of the corn refining industry, the annual grind of the industry is usually about 30 percent of the receipts at primary corn belt markets and is roughly 15 percent of all corn sold off United States farms.

In the last two years the grind of the industry has about doubled, the 1941 capacity being estimated at 110,000,000 bushels of corn against about 75,000,000 bushels in 1938-39.

Annual production of cornstarch is now estimated at about 1,500,000 pounds, almost double the production in 1940. Domestic uses of corn starch are estimated at 1,200,000 pounds.

Corn refining is essentially a mechanical process, but it is on a definite chemical basis, and chemical control is very exact at certain points.

First process is steeping. The corn kernel has a hull of fibre. Next inside is a shallow layer of gluten; inside that a mixture of gluten and starch bulging toward the center; the center is white starch, and at the lower part of this center is the germ itself, about 50% oil but containing also some protein and some minerals. Steeping is the first process for loosening these parts from each other.

The cleaned corn ready for steeping flows into huge tanks where it is soaked for about two days in warm water containing a small amount of sulphur dioxide. This steeping loosens the hull and softens the gluten, and a small amount of sulphur dioxide in the water prevents fermentation.

The water is then drawn off and concentrated in vacuum evaporators to a heavy syrupy liquid, called concentrated steep water, which is ultimately used in making cattle feed.

The remaining steeped corn is then ground in "attrition" or "degerminating" mills which crack or tear the kernel to pieces so as to free the germ but not crush it.

The macerated corn then goes into deep V-shaped tanks called "germ separators," full of starch milk. The germ, because of its oil content, is lighter than the rest of the kernel, and floats to the surface and over a dam-like weir.

This skimmed-off by-product germ is then washed free of adhering starch and gluten, pressed in "squeezers" to remove as much water as possible, and then dried in rotary steam dryers. The dry germ, containing over 50% of oil, is ground into fine particles and put through "expellers," which squeeze out the oil and leave a hard "oil cake" which is then broken up to form oil cake meal for use as feed or in feed.

Meantime the crude oil from the germ is filter-pressed, then allowed to settle in large tanks, from which the clear oil is drawn off. This is then treated with alkali to neutralize

the free fatty acids and improve the color. The removable matter, or "foots," is used by soap makers. The oil is then passed through refrigeration machines, clarifiers, deodorizers, filters, and sterilizers. Most of the oil is eventually used as a table, salad and cooking oil.

Meantime the hull, starch, and gluten—minus germ—from the bottom of the "germ separators" is ground in "Buhr mills" (one large stone revolving over another large stationary stone) to loosen the fibre and hull from the starch and gluten. The resultant wet mash is washed through a series of reels which sidetrack the particles of hull and fibre. They go off for feed.

For this purpose these hull and fibre particles are washed of remaining starch and gluten, put through squeezers or presses to remove excess water; and sent to rotary dryers.

Last of all, the gluten also is separated out, leaving nothing but the main product, the raw corn starch.

The water and gluten are collected in large settling tanks to stand until the gluten settles to the bottom. Then the water is drawn off and the thickened gluten is pumped through filter presses to get even more water out of it.

Thereupon a final by-product operation combines the three by-products already mentioned—the steep-water, the hulls and fibre, and the gluten, and makes "corn gluten feed" of them. The gluten is mixed with the hulls and fibre and the result sprayed with concentrated steep-water to give it added minerals for nutritive value.

We now have left the starch from the reels and shakers. This is destined for a wide variety of products. It is to go to market in four principal forms—as starch; as dextrin; as syrup; and as sugar.

From the starch tables where the gluten was separated, then, the starch is flushed out and passed repeatedly over filters for purification. Then the starch to go to market as corn starch is taken directly from the filters in cake form containing about 45% moisture, loaded in wagons and put through drying kilns for 24 hours. It is then milled, passed finally over silk reels to take out all remaining grit and hard particles, and sent to the packing room where cartons are filled, weighed and labelled automatically. Laundry starch is made by partly cooking the starch and pressing it into cylinders at about 800 pounds pressure for 30 hours. The large lumps are then broken and screened. This pressure cooking makes the starch partly soluble.

Only about 15 percent of all corn starch reaches the consumer in the form of retail packages of edible starch, laundry starch and miscellaneous products of the manufacturing companies.

The remaining 85 percent constitutes a bulk goods business. Starch is a raw material or semi-finished essential for about 30 large and small industries, of which the most important in relation to volume of starch used are cotton textiles, brewing, paper, baking powder, laminated and corrugated boxboard, confectionery, baking (apart from baking powders), paste and asbestos, commercial laundering and chemicals.

Corn starch is variously used as a stiffener, binder, filler, finishing and surfacing material, moulding material, suspension medium, fermentation agent, and a chemical. Nutritionally it is a carbohydrate, or energy food. It is highly adaptable to modification to produce innumerable physical effects and upward of 300 varieties and modifications are in daily use.

One bushel of shelled corn, weighing 56 pounds, will convert to 33 pounds of cornstarch.

Corn starch prices on July 1, 1942 for the important grades and types were: Pearl thin boiling starch, in bags, $4.07 per hundred

pounds, in barrels \$4.49; crystal thick, in bags \$4.17, in barrels \$4.59; pearl starch, in bags \$3.47, in barrels \$3.89; powdered in bags \$3.57, in barrels \$3.99.

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Corn Sugar

PRODUCTION of corn sugar by the United States corn refining industry is expected to reach 750,000,000 pounds (375,000 short tons) in 1942 or about 5 percent of the country's normal annual consumption of cane and beet sugar. This will be a top output contrasting with just over 400 million pounds annually for the five year period of 1936 through 1940, inclusive.

In making corn sugars the starch (see corn starch) is treated just as in syrup making (see corn syrup) but the process is continued until the starch is almost entirely dextrose.

Chemically, dextrose is defined as "A crystalline dextrorotatory sugar, $C_6H_{12}O_6$, occurring in very many plants and in the animal organism; — called also grape sugar, dextroglucose, or simply glucose. It can be obtained with levulose, by inversion of sucrose (cane sugar), but is chiefly made from starch by the action of heat and acids."

For crude sugars the final liquor is poured into special tanks and cut into large slabs as soon as partially crystallized. These slabs are then cured or aged, come out slightly brown, and are called "seventy" or "eighty" sugars, indicating the percentage of dextrose, the rest being water and dextrins. They are chiefly used in the rayon industry and in sole leathers.

Pressed sugars are obtained by squeezing the liquor from convertors in hydraulic presses, separating out most of the sugar and forcing out corn molasses. Refined corn sugar is made by crystallizing the finished syrup in the same type of machines used in the cane sugar industry.

Although no exact figures are available it is believed that more than 300,000,000 pounds of the production of these two broad classifications of sugars, is dextrose (refined corn sugar) while the remainder consists of so-called "crude" sugars. The industry also provides sugars of different specifications for the brewing industry (Brewers' Chips) and for lactic acid production.

Two types of dextrose are made. The first is the hydrate form in which the crystal contains some water of crystallization and the second is an anhydrous dextrose which, in commercial quantities is produced with an actual purity of 99.9999. This purity is an extraordinary characteristic of any substance and is regarded with high interest by scientific and experimental experts as a potential source of new materials and compounds. Ordinarily, the minute quantities of impurities of an obscure nature in most chemicals are a source of hindrance and annoyance in experimental work. The purity of dextrose, with a ready source of supply without undue cost, has resulted in the development of a series of new dextrose derivatives for experimental purposes which may be of importance in the future, although at the present time the major volume of anhydrous dextrose still goes into food use.

The rationing of cane and beet sugar, up until the end of June 1942, has not brought with it any restrictions on the deliveries of corn sugars. However, the industry itself has been serving old customers and the usual industries first — in that way effecting a "voluntary" rationing plan.

On July 1, 1942 — "70" corn sugar, chipped, in bags was quoted at \$3.62 per hundred pounds; "80" sugar at \$3.80; and dextrose in cotton bags at \$4.50.

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Corn Syrup

PROCESSING of corn syrup from crude corn starch is carried on in the United States by eleven companies, comprising the corn re-

fining industry, which operate thirteen plants all within the corn-raising states of the Middle West—Illinois, Iowa, Indiana, Michigan, Missouri, and Ohio. (See corn starch.)

To obtain corn syrup, the starch is mixed with water and heated in the presence of weak acid. It breaks down by hydrolysis into dextrin, maltose and eventually into dextrose, the same sugar that is present in the human blood stream. But this action is interrupted to obtain the syrup. Corn syrup is made by heating starch in a closed tank or "converter," with dilute hydrochloric acid. At a certain point the liquid is moved into a neutralizing tank where the acidity is neutralized by adding soda ash. The syrup is then filtered through bone char or charcoal and evaporated to the proper consistency.

The resultant corn syrup is chemically a combination of dextrose, maltose, dextrin and water. For the table, a small percentage of refiners' cane syrup is added for sweetness.

From one bushel of shelled corn about 37 pounds of corn syrup are obtained.

The annual production of corn syrup is about 1,200,000,000 pounds. Approximately 35,000,000 pounds went into export trade in 1941. Of the domestic consumption well over half of the total is used by manufacturing confectioners, or about 600,000,000 pounds. Another 350,000,000 pounds is used in making mixed syrups, two-thirds of which is mixed and marketed by the industry and the remainder by independent mixers. Other consumers in order of relative importance are bakers, brewers, makers of jams, jellies and preserves, non-food technical processes, tobacco products and ice cream.

Corn syrup is essentially a carbohydrate food and is both a sweetening agent and a major ingredient of many food compounds by reason of its high nutritional value and its unique physical properties. Being composed of a single molecular sugar, dextrose; a double molecular sugar, maltose; and the pro-sugar, dextrine, it is a retardant of crystallization, a stabilizer and a blending agent and producer of correct body and texture in combination with other ingredients in many foods. It is important medically as an asset in the nutrition of infants, particularly in the premature, and in cases of digestive disturbance.

Corn syrup is not only marketed as a liquid in varied concentrations and characteristics, according to the specified use, but is also marketed in dry form, when it is handled and used like a dry sugar. In these forms it is referred to as "dehydrated corn syrup" or as "corn syrup solids."

While sugar rationing has greatly enhanced the demand for corn syrup, the industry has been unable to expand production more than 10 to 20 percent in 1942. Plants began operating at capacity in the middle of 1941 and have been in full production since.

At the end of June 1942, unmixed corn syrup 42 degrees Baume was quoted at $3.23 per hundred pounds in tank cars, and at $3.79 in barrels. The 43 degree syrup prices were $3.28 and $3.84 in tank car and barrel lots while the 45 degree quality was quoted at $3.42 and $3.98 respectively.

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Corn Whiskey

See Distilled Spirits

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Cornwall Stone

See Feldspar

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Corrosive Sublimate

See Mercury Chlorides

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Cortica Nacional

See Pao Santo

Corundum

CORUNDUM is a native alumni or aluminum oxide (Al_2O_3), valued as a gem when pure but mostly imported for use as a superior abrasive. It has a hardness of about 9, exceeded only by the diamond.

It is used mostly for the grinding of lenses and other glass surfaces.

Corundum has not been mined in the United States in recent years. In 1940, imports of crude corundum amounted to 5,718 short tons against 2,098 tons in 1939. It comes chiefly from South Africa although it is reported to be widely distributed in parts of India. Most of the corundum is imported crude and is crushed and graded in the United States. Varieties range from deep red to pink and light gray, in color, there having been no sustained effort to market a clean concentrate. Imports in 1940 were valued at $73,795.

The ruby is a red corundum; the sapphire a blue variety; and the Oriental topaz a yellow corundum. Artificial corundum for use as an abrasive is now manufactured extensively and marketed under various trade names.

The War Production Board, by Order M-89, effective Feb. 7, 1942 restricted the delivery and required reports on corundum. "Corundum" was defined as "naturally occurring crystalline anhydrous aluminum oxide suitable for abrasive use and not artificially bonded. Emery, ruby, sapphire are specifically excluded."

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Cotton

COTTON is historically a new textile fibre, its importance a result of the Industrial Revolution and the application of steam power to improved spinning and weaving machinery.

Most of the world cotton crop is grown in the Northern Hemisphere, and is planted in the Spring and harvested in the Fall. In the Southern Hemisphere, the reverse is the rule. The Cotton Belt in the United States extends from the extreme southern part of Texas well up to the Mason-Dixon line. Cotton usually is planted as soon as the weather is warm enough, and so the planting season covers a long period if it is counted from the time the first cotton is seeded in the Rio Grande Valley of Texas until the operation is completed in the upper part of the Belt. Cotton planting often begins in January in the extreme South, and sometimes is not completed in the northernmost part of the Belt until the end of June, when the "first bales" have been ginned or are about to be ginned in the far South. In a big crop season, picking and ginning may not be completed in the northern Belt until February or March, by which time new crop cotton already is up in southern Texas. Accordingly, "Spring" and "Fall" can be considered only as general terms rather than specific time periods. This is true also in foreign cotton-producing countries.

Cotton is planted in rows, and the first operation after the plant is sufficiently large is "chopping," that is, thinning out superfluous plants. Following this comes "hoeing," in which operation the soil is broken and pulled around the plants. Thereafter, "cultivating" by animal or tractor-drawn apparatus aerates the soil and destroys "grass" or weeds. When the plants become too large for continuing cultivating, the crop is "laid by" until harvest.

In the eastern two-thirds of the Belt, rainfall usually is ample throughout the growing season and droughts are infrequent; in the West, however, rainfall normally is light and cotton sometimes is subjected to severe damage from drought. Once the crop is planted, variations such as occur in the yield per acre from year to year depend largely upon the amount of rainfall. Cot-

ton is a semi-tropical plant, and thrives on high temperatures provided moisture is sufficient. Excessive moisture, accompanied by only moderate temperatures, creates a heavily foliaged plant which bears little "fruit." In addition to the weather, yields depend on the degree and activity of a wide assortment of insect pests. The most serious threat in that respect is the boll weevil. The use of fertilizer also is important. Cotton is picked, usually by hand, and is loaded into wagons holding about 1500 pounds of "seed cotton" for hauling to the "gins" where the seed is separated from the "lint" cotton.

The United States produces more cotton than any other nation in the world. India ranks second followed by Russia, Brazil, Egypt and China. Texas is the largest producing state of the Union. Other important producing states are Mississippi, Arkansas, Georgia, North and South Carolina, Alabama, Oklahoma, Louisiana and Tennessee. World production averages about 28 million bales annually. The average U. S. crop in recent years has been around 12 million bales.

The major portion of the world cotton crop is manufactured into articles for apparel and household use. Household goods include bed and table "linen," bath and kitchen towels, blankets, rugs, upholstery, window shades and curtains, wall hangings and coverings, mops, dusters, etc. Some cotton is used, unspun, for stuffing mattresses. The remaining large use of cotton is styled "industrial"; this includes bags, automobile tire fabric, webbing for machinery belts, harness, and conveyors; cloths for rubberizing and chemical treatment; yarns for insulating telephone, telegraph, cable and electric power wires; tarpaulins, sails, and fishing nets; covers for wagons and trucks, and so on through an unlimited number of uses. Hospitals use large amounts of cotton for bandages and dressings, while the use of cotton in athletic goods is increasing steadily. Since the outbreak of war, cotton has been used extensively for military purposes.

In addition, large amounts of heavy cotton fabrics are being used to substitute for burlap in military and essential civilian uses. As a result, cotton consumption has mounted to hitherto unprecedented levels.

Cotton is packaged into a bale of approximately 500 pounds; the bale is covered with jute, burlap, or cotton bagging, and is bound with iron "ties." In the eastern part of the Cotton Belt, these large "gin bales" move directly to mills, in many instances. When cotton has to be shipped long distances, it is compressed to medium density at interior "compress points"; if cotton is to be exported, these medium density bales are compressed to high density. The resultant savings in freight and shipping space far more than offset the cost of compression.

The price early in 1942 approximated 20 cents per pound. Transportation is mostly by rail and water.

American cotton is classified according to grade and staple by standards established by the Department of Agriculture. The "grade" of any given sample of cotton is determined by the quantity of leaf and trash still left after ginning, and by the color of the cotton. Cotton picked soon after opening is almost pure white, while cotton left for a long time in the fields after opening often is a dirty gray or "blue." Frosts and freezes sometimes impart color described as yellow or red. The "staple" of any given sample of cotton refers to the length of the bulk of the fibres, expressed in inches and fractions thereof. Choice of seed, soil characteristics, degree of fertilization, and length of the growing season are the principal determinants of staple. Some American cotton shorter than $\frac{7}{8}$ inch is produced, while some is longer than $1\frac{1}{4}$ inch; the modal group is between 15/16 inch and 31/32 inch. The "standard" description of American cotton is "middling 15/16 inch"; mid-

dling refers to the grade and 15/16 inch to the length of the fibre. (The standard formerly was middling 7/8 inch.)

For "fine goods," such as broadcloths for men's shirtings, manufacturers use the longer staple cottons. Short cotton is used in the manufacture of heavy goods such as ducks, drills, and osnaburgs. Print cloths, sheetings, and tire yarns generally are made from medium length cotton. Some wasty, trashy cotton is unsuitable for spinning and is used for stuffing mattresses and upholstery. Since cotton is subjected to thorough cleaning before the spinning process commences, the grade of cotton is not so important as the staple unless the cotton contains such a large amount of leaf and trash that it all cannot be removed or unless the cotton is "off color." Manufacturers of fine goods demand clean, white cotton, while manufacturers of heavy goods generally can use the lower grades.

The chief substitutes for cotton are rayon and rayon staple fibre.

There is an import duty of 7 cents per pound on 1 1/8 inch cotton and longer. Shorter cottons are not subject to import duties, but all cottons are under import quotas.

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Cotton Linters

LINTERS are the cotton fibres or fuzz that adhere to the seed after separation from the lint. They are usually about 1/8 inch in length or shorter and are removed from the seed after ginning.

Production is centered in the Cotton Belt States of the south. Output usually ranges from 1 million to 1.2 million bales annually. Linters are used primarily as stuffing for mattresses and upholstery and as a raw cellulose material in the production of rayon. They have an important wartime use in the manufacture of smokeless powder and are also used in the production of pyroxylin plastics.

The marketing unit is the bale of about 500 lbs. gross. Transportation is by rail and water. The principal types are felting and chemical. Substitutes are wood pulp and some low grades of cotton. There is no duty on linters.

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Cottonseed

COTTCNSEED is the seed of the cotton plant. It is produced in conjunction with cotton and has many important uses.

A number of factors combine to determine the quantity of cottonseed that will be produced in any given season. Among such factors are: the acreage planted to cotton, the weather during the growing season, the degree of insect infestation, the extent of plant diseases, the type of seed planted, and the care taken of the crop during the growing season. With the exception of the weather, all of these factors are subject to greater or lesser degree of control. Since cottonseed are a by-product, their price has little or no influence upon production.

Most important of the above factors is, of course, the acreage planted to cotton. During recent years, this has been limited by the Federal government. With restrictions upon acerage, producers have expended greater efforts toward controlling other factors of production. As a result, yield per acre has been substantially increased. It is estimated that, at the present time, approximately 600,000 tons of cottonseed are destroyed each year by insect infestation. Substantial additional quantities are lost by the planting of poor seed, improper preparation and cultivation, and plant diseases. Not all these losses can be eliminated but a considerable proportion of them can be. The cottonseed industry is at present assisting growers to reduce such losses in order to assure supplies of raw materials.

Cotton picking time begins in South Texas about the first of July. It moves northward as the season advances. In the northern part of the Cotton Belt, picking usually begins about the middle of September.

As it is picked, cotton consists of clusters of seed to which the lint tightly adheres. In this form it is known as "seed cotton." The growers transport this seed cotton to the gin. In the late summer and early fall, roads in the Cotton Belt are choked with wagons and trucks, loaded with seed cotton, moving to the gin. There are about 12,000 active gins throughout the cotton growing area and few farmers have to carry their cotton as much as ten miles.

At the gin, seed cotton is separated into lint and seed. The lint is baled and usually is returned to the grower to be marketed by him. In most cases, seed are sold to the ginner who accumulates many small purchases into carlots which he then sells to the oil mills. Some growers market their own seed. They may sell it directly to an oil mill, to a local seed merchant or to a commission buyer representing a mill. The greater part of the cottonseed crop, however, is sold to ginners who resell it to the oil mills.

The average manufacturing loss, which ranges from 100 to 150 pounds per ton of seed, is made up of dirt, trash and excess moisture. Both the total yield and that of the individual products vary considerably from season to season, from region to region, and from one lot of seed to another. In a single State during a single season, seed have been found to yield as little as 145 pounds and as much as 395 pounds of oil per ton, and as little as 693 pounds and as much as 1,036 pounds of cake or meal per ton. Generally, cottonseed produced in Oklahoma and Texas yield less oil and more cake or meal than seed produced in other parts of the Cotton Belt. The yield of linters is usually higher in the Valley States and in California than in other localities.

In addition to variation in the yield of products, cottonseed also vary in quality. Quality variation results primarily from three factors; the type of seed originally planted, climatic conditions during the growing season, and the degree of care with which seed are handled. During a single season, seed may contain as little as 5 per cent or as much as 30 per cent moisture. In processing, moisture in excess of 7 per cent is lost. Moist seed under certain temperature conditions, also have a tendency to heat (incipient germination) which causes spoilage and creates a considerable fire hazard. When processed, such seed not only contain a smaller quantity of salable products than good seed, but the quality of these products is also lower.

Because of the highly variable character of the commodity, the purchase of cottonseed involves considerable risk. In the early days of the industry, cottonseed were "graded" merely by inspection. This was a most uncertain method, subject to serious error. Gradually, the industry learned more and more about the chemical composition of seed. Today, practically every mill has its purchases chemically analyzed either by its own chemist or a commercial laboratory. Periodic analyses are made and the mill bids for seed on the basis of the average "grades" within its territory.

Cottonseed production in 1941 amounted to 4,892,000 tons. The leading producing states were Texas, Arkansas, Mississippi, Alabama, Oklahoma, Georgia, Tennessee, North Carolina, Missouri, California, South Carolina and Louisiana.

The cottonseed industry is considered a war industry because of the strategic importance of its products. With the cutting off of more than 1,000,000,000 pounds of fats and oils, normally imported from the Far East, cottonseed oil becomes more im-

portant than ever in the nation's food supply. The U. S. Dept. of Agriculture recommended an increase of about 4,000,000 acres in cotton production in 1942 over 1941, primarily as a means of increasing the production of oil. The industry, which has available ample capacity, was also called upon to process the greatly increased supplies of soybeans and peanuts.

Cottonseed cake and meal, a protein concentrate feedstuff, are an important factor, in the "Food For Freedom" program, one objective of which is to materially increase the nation's output of meat, milk, eggs, and other animal products, for ourselves and the other United Nations. The projected increase in the production of livestock products could be achieved without sufficient protein in feeding rations. The 2,000,000 tons of cottonseed cake and meal to be produced in the 1942 season was to constitute a major part of this essential protein supply.

Cottonseed hulls also play a significant role in the "Food For Freedom" program. Hulls, which are fed to livestock as a roughage, provide a valuable supplement to the hays and grains produced on farms.

Cottonseed linters are under allocation by the War Production Board. Linters normally are used in mattresses, motor vehicles and furniture, and in a wide variety of products produced by the chemical industries, notably rayon, plastics, lacquers and explosives. Since August 1941, the industry had been required to sell 80 percent of its linters production to the chemical industry but early in 1942, it was notified that it would have to dispose of 100 percent of its output through such channels during the impending season. Most of the linters so marketed are being used in the production of smokeless powder for the armed forces. The balance enters products considered essential to the war effort.

The marketing unit for cottonseed is the ton. The average price received by farmers in April, 1942, was $43.90 per ton. The price for cottonseed meal in the same month (41% protein) averaged $35.25 per ton in Memphis. The industry has operated under a price ceiling (informal) for linters since August, 1941. The maximum price is 3.35 cents per pound, basis 73% cellulose, F.O.B. mills, Ceilings were placed on meal and hulls by the General Maximum Price Regulation.

After many years of study in cooperation with the industry, the United States Department of Agriculture developed a system of seed grading. This system is based upon the amount of oil, ammonia, moisture and foreign matter present in the seed and the percentage of free fatty acids in the oil in the seed. Seed containing a certain quantity of the above constituents of a given quality are known as "basis" seed and graded 100. In buying seed "on grade," the mill offers a price for "basis" seed. A sample of the purchased seed is chemically analyzed by a chemist licensed by the Department of Agriculture. If the seed grades above 100, the seller receives a premium; if it grades below 100, a deduction is made from the original offering price. This grading system is not compulsory and at present is in general use only in the Valley States and in certain sections of the Southeast. The major portion of the cottonseed crop is still bought "as is," on the basis of average grades.

The duty on cottonseed is ⅛¢ per pound. The duty on cottonseed oil-cake and meal is 3/10¢ per pound.

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Cottonseed Cake

See Cottonseed

★ ★ ★

Cottonseed Hulls

See Cottonseed

Cottonseed Linters

See Cottonseed

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Cottonseed Meal

See Cottonseed

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Cottonseed Oil

OF ALL the products of the cottonseed, the oil is the most valuable. It is pale yellow when pure and contains mostly olein, linolein, palmitin and stearin. Processing operations, before pressing, consist of separating the seed from the lint, cleaning, removing of the linters and hulling. Processing yields cottonseed cake and oil. The oil is then refined.

Most oil today is refined by centrifuge. Sodium hydroxide which is added after the oil has been heated to a high temperature combines with a portion of the oil to form a semi-solid mass known as soap stock. Centrifugal action separates this from the clear yellow oil which is then further purified by deodorizing and for some purposes, by bleaching. The result is a neutral oil, odorless, practically colorless, neutral in flavor, and suitable for food.

Crude oil production in the 1940-41 crop year amounted to 3,563,678 bbls. and refined oil output in the same period was 3,361,128 bbls. (400 lbs. each).

The most important single use of cottonseed oil is in making shortenings. These shortenings are of two types—those made by combining cottonseed oil or other vegetable oils with animal fats, and those made by the process of hardening cottonseed oil alone or in combination with other vegetable oils.

In the early 1900's the discovery of hydrogenation made it possible to turn a liquid oil into a solid fat. From this came the manufacture of shortenings and solid cooking fats entirely of refined cottonseed oil or other vegetable oils. Hydrogenated products have definite advantages. They do not easily spoil and can be kept for a long time at ordinary temperature without losing their original flavor. Air can be beaten into them, so that cakes, pastries, etc., made with them are light and fine-textured.

Margarine is made principally from cottonseed oil. Refined oil and milk, usually in the proportions of four to one, are run into a sterilized container; salt is added and the mixture blended thoroughly. It is then cooled rapidly, which enables it to solidify. Excess moisture is pressed out and the product allowed to stand for a day or two; it is then shaped and machine-packed.

Cottonseed oil is also used as a preservative in packing sardines and cured meats. Only "soapstock" or off-grade oils are used in inedible products, such as soap, paint, linoleum, ink, and a number of other products. All prime cottonseed oil is used in food.

The marketing unit is the pound and price quotations are on that basis.

A ceiling was placed upon the price of cottonseed oil in December 1941. Ceiling prices, as revised to May 6, 1942 are shown as follows:

"An amendment to Price Schedule No. 53, setting specific maximum prices on cottonseed oil, provides that the maximum price for crude oil at mills shall be as follows:

No. Carolina, So. Carolina and Tennessee, 12.75 cents; Mississippi Valley, Alabama and Georgia, 12.625 cents; Texas and Oklahoma, 12.50 cents.

Maximum prices for refined cottonseed oil in tank cars, delivered, are as follows:

	Bleachable prime summer yellow	Cooking or deodorized summer oil	Salad or winterized oil	Hydrogenated or margarine oil	High titre hydrogenated oil
	CENTS PER POUND				
San Francisco, Calif.	14.50	15.32	15.70	15.90	16.05
New York, N. Y.	14.30	15.12	15.50	15.70	15.85
Columbus, Ohio	14.28	15.10	15.48	15.68	15.83
Chicago, Ill.	14.23	15.05	15.43	15.63	15.78
Cincinnati, Ohio	14.23	15.05	15.43	15.63	15.78
Louisville, Ky.	14.19	15.01	15.39	15.59	15.74
St. Louis, Mo.	14.14	14.96	15.34	15.54	15.69
Charlotte, N. C.	14.09	14.91	15.29	15.49	15.64
Kansas City, Mo.	14.09	14.91	15.29	15.49	15.64
Memphis, Tenn.	13.99	14.81	15.19	15.39	15.54

The usual differentials, above and below the delivered prices listed, shall apply to all other destinations. Normal differentials for grades are to continue to apply. The maximums established shall apply to futures contracts traded on the New York Produce Exchange and on the New Orleans Cotton Exchange."

The chief substitutes are lard and vegetable oils such as peanut and soybeanoil. The duty for either crude or refined cottonseed oil is 3¢ per lb.

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Cottonwood

See Hardwoods

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Cow Hides

See Cattlehides

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Crabs

THE great bulk of the crab production is made up of the blue crab, abundant from Maine to Texas on the East Coast.

The 1940 production of crabs was as follows: Hard, 91,678,000 pounds valued at $2,305,000; soft, 4,390,000 pounds, valued at $418,000; King (Pacific Coast) 10,000 pounds, valued at $1,000; King or Horseshoe crabs, 1,704,000 pounds, valued at $4,000; Stone, 132,000 pounds valued at $12,000.

The 1939 production of crabs was: Hard, 85,482,000 pounds, valued at $1,525,000; soft, 6,499,000 pounds valued at $532,000; King, (Pacific), 14,685,000 pounds, valued at $741,000; King or Horseshoe, 2,699,000 pounds, valued at $6,000 and Stone, 49,000 pounds, valued at $9,000.

Clearly indicated is the rise in both hard and soft shell crabs for the year 1940. These are the blue crabs. During the past year investigations of the Fish & Wildlife Service, Department of the Interior, show that the development of a large crab canning industry on the West Coast and in Alaska is very possible. This is expected to develop because of the great abundance of the King crab in that area.

A new process for canning crabmeat, hermetically sealed and processed, was developed on the East Coast during the past couple years with the result that great quantities of this pack are now being canned. It is hoped that this will replace the imported packs of Japanese crabmeat which, a few years back, dominated the canned crab market.

Crabmeat (cooked) is packed in tins of one and five pounds, both fresh and frozen. Hard

crabs run from 3 to 6 pounds to the dozen (Atlantic and the Gulf) while the Pacific hard crabs are 20-22 pounds to the dozen. Soft crabs from the Chesapeake, Middle Atlantic, South Atlantic and the Gulf, range from $1\frac{3}{4}$ to $4\frac{1}{2}$ pounds per dozen.

Soft crabs are shipped alive in four sizes: "Culls" about $3\frac{1}{2}$ inches in width; "Medium," 4 to 4.5 inches in width; "Prime," 5 to 6 inches and "Jumbos," above 6 inches in width. They are packed in moist seaweed, in shallow wooden trays, 3 to 4 inches in depth, covered with vegetable parchment paper over which more seaweed and ice are spread. Two or three trays are placed in a crate. Common size crates of prime crabs weigh 80 pounds and hold about 15 dozen crabs.

Hard crabs are shipped alive in barrels, well iced. These are usually the large, whole crabs called "Jimmies."

Crabs go by truck and express to markets all over the country.

The soft crab fishery is limited to late spring, summer and early fall. Soft crabs are obtained only from the moulting of the younger crabs which takes place only during the warm weather. A soft crab is exactly the same as the hard shell but is minus the hard shell. A "peeler" is a crab about to moult but not yet free of its shell.

Soft crabs and peelers are caught in dip nets or scrapes although a few are caught by trot-lines. The scrape, the trot-line and the dredge are used for hard crabs. The trot-line is most common. Crabs are caught the year round but in the winter they bury themselves in the sand and mud and can be taken only with the heavy dredges.

For packing of crab meat, fat crabs yield about 20 pounds of meat per barrel while poor crabs yield but 15 pounds per barrel. A gallon of meat weighs about 5 pounds. Waste shell, etc., after the meat has been picked out (crabs are cooked before meat is picked) are sold to by-products factories as scrap.

There are a number of different crabs most of which are of very minor importance. Among them are: Green crab, Fiddler crabs, Hermit crabs, Horseshoe crabs, Jonah crabs, Kelp crabs, Lady crabs (sand, squeaker), Mud crab, Mussel crab, Oyster crab, Purple shore crab, Red crab, Rock crab, Sand bug. Spider crab, Stone crab, and Yellow shore crab. The blue crab however, as stated before, is the big producer. The King crab of the Pacific is developing in importance.

The crab fishery is affected by the war chiefly in the matter of lack of tin containers. However fibre containers may be the answer to this problem.

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Cresylic Acid

CRESYLIC ACID is a liquid ranging in color from yellow to straw to brown, or pink to red to cherry, and is composed of a mixture of the acids derived from the distillation of tar, in varying proportions, including phenol, the three cresols, the six xylenols and the acids boiling above the xylenol range. It is customary for producers to generally refer to tar acids as phenol if benzophenol predominates and as cresol if distillation is low enough to assure predominance of the cresols.

Cresylic Acid is produced by caustic soda extraction of tar acids from the carbolic oil fraction of the distillation of tar, springing the cresylates and phenolates so obtained by a weak mineral acid and distilling the resulting wide boiling tar acid fraction. Tar is produced in the coking of coal. Total production is indefinite, depending upon demand.

Principal uses are for manufacture of synthetic resins, trycresyl phosphate, preparation of lubricating oils, production of disinfectants, for flotation of ores and in combination with various kinds of soaps.

The marketing unit is the gallon for cresylic or pound for cresol or phenol. Price depends upon specification; the price in mid-1942 for

cresylic acid was from 70¢ to 83¢ per gallon for domestic grades. It is transported in tank cars and iron drums of 55 or 110 gallon capacity.

Cresylic Acid never perishes. It gets darker upon exposure to light and air but can be lightened by redistillation. It never loses its germ destruction properties.

The principal type is 99% tar acid guaranteed and distillation range shows relative percentage of cresols, xylenols, etc. Substitutes for cresylic acid are dependent upon industry in which cresylic acid is used and so many uses for it make it impractical to enumerate them.

Cresylic Acid has very important war uses such as plasticiser for degaussing cable, resins for airplane, motor car and tank parts, disinfectants for hospital use and flotation of copper ores.

Foreign acid duty is 20% advalorem plus 3½¢ per pound if distillation shows 75% or more off at 215° C. If less than 75% distills at 215° C., material is duty free.

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Crude Oil

See Petroleum

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Crude Rubber

See Rubber

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Cummin Seed

This spice seed is imported from the following areas in the order of their importance: Casablanca, Morocco; Cyprus, British India; Spain; Malta; Turkey; Syria, and Mexico. Total annual world production is about 2,000 tons. Principal use is in spice manufactures, especially in sausage and other meat products. The approximate price in May, 1942, was 15 to 16 cents per pound compared with 9 to 10 cents a year previous. Principal grades are Black and White with industry generally favoring the latter. This product retains good merchantable quality from one to two years, according to trade interests. There is no U. S. duty.

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Cutch

See Catechu

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Cypress

A product of the deep south, Cypress is a soft durable wood, orange to reddish in color. It grows in deep swampy land. In the United States, in 1940, a total of 405,011 thousand board feet were cut for lumber. The leading producing states were Florida, with 121,506 thousand feet of the total; Louisiana, 68,440 thousand feet; and South Carolina 54,992 thousand feet.

Because the wood imparts no taste or color, it is used extensively for tanks of various purposes. It is known as the "Wood Eternal" because of its resistance to rot and decay. The redwood of California is nearest akin to cyprus for purposes requiring long life. Cypress is also utilized, because of its properties, for exterior exposure purposes.

Average mill value is $70.60 per thousand board measure, the highest grade being "Tank" and the lowest "Pecky'.

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Dates

Dates are the fruit of the palm tree, and constitute a staple food for the people of Northern Africa and Western Asia. The date is an oblong berry with a grooved seed, the latter yielding an oil and when ground

is sometimes used as a substitute for coffee. In the United States, dates are grown commercially in California and Arizona.

The bulk of the consumption of dates, which are marketed in dried form, is direct to the consumer. Confectioners and bakers use dates to a limited extent, with their use by the baking trade growing in recent years in breads and cakes.

The war has strengthened the sales position of the domestic industry, both in the United States and Canada. Normally, approximately 50,000,000 pounds of dates are imported largely from Basrah, though imports have been decreasing gradually since 1936, when a high of 58,000,000 pounds was imported. During the first nine months of 1941, the last period for which data are available, imports were only 19,142,000 pounds.

The resultant scarcity of imported dates has stimulated the date-packing industry in California and Arizona, and prices have been sharply higher, with packers experiencing no difficulty in disposing of their entire output. Domestic production has risen from an average of 77,000 pounds in the period 1915-19 to a total of 10,272,000 pounds in 1941.

The unit of purchase from the grower and packer is the pound. In commercial trading, pitted dates are packed in 66 pound boxes on imported varieties, while in consumer sizes 8-ounce to one-pound packages, either in cellophane or in cartons, are the normal unit. Domestic are packed in 15-pound wood boxes and 8 to 14 ounces in consumer sizes. Dates are marketed in both unpitted and pitted form, the latter commanding a price premium.

No quotations on imported dates are available, the last sales being at 21 cents for pitted Sayers. Hallowis, the other imported variety, generally sell higher than the Sayers. The bulk price for domestic normally marketed merely as "California dates", was 20 cents per pound in wholesale channels during July, 1942 with prices for the smaller consumer sizes showing the usual brand differentials.

While domestic dates normally move eastward largely by steamship, the movement is now a rail one due to the shipping shortage.

Dates are a perishable food, and require cold storage. As is the case with other dried fruits, they require careful handling to prevent insect infestation and weather damage. No commonly-accepted substitute for dates exists.

The import duty on dates is 1 cent per pound on unpitted and 2 cents per pound on pitted fruit.

Pitted dates come within the provision of the General Maximum Price Regulation.

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Dextrin

DEXTRINS are processed from crude corn starch by the corn refining industry and constitute the second important use of starch, the first being refined corn starch.

They are made by treating the dry starch with a small amount of some mineral acid and roasting it in cookers. Dextrin is chemically intermediate between starch and the sugars and syrups that can be derived from starch. More than a hundred different kinds and blends of dextrins are made from corn starch. Finished, they appear as powders varying from pure white to light yellow. From 140,000,000 to 145,000,000 pounds a year are so made. Dextrin is used for wood veneer, glue, labels, stamps, gummed envelopes, and other paper work; as a binder for other materials, also in "electric sparkler" fireworks, where the dextrin holds inflammable material and powdered metal together on the wire center. It is used for foundry molds, sizing for the backs of carpets, and in coal briquets and electric batteries.

Dextrins in their marketable form are

not to be confused with the dextrine content or pro-sugars of the corn syrups.

In mid-1942—white dextrins, in bags, were quoted at $4.32 per hundred pounds; in barrels at $4.74; while canary dextrin, in bags was priced at $4.37.

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Dextrose

See Corn Sugar

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Dextro-Tartaric Acid

See Tartaric Acid

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Diamond Dust

DIAMOND DUST is an abrasive material which is crushed from the small and shattered shapes of the Bortz diamond, in appearance somewhat similar to carborundum or other abrasives. It ranges from light gray to dark gray in color. It is processed by pulverizing Bortz diamonds. The principal sources of Bortz diamonds are the Union of South Africa, Belgian Congo and Brazil, as well as many other countries throughout the world. Practically no diamonds are found in the United States. World production of Bortz diamonds from all sources combined, averages a few million carats per year. The production of diamond dust depends directly upon the demand from industry which may be estimated at close to one-half million carats each year. The dust is used as an abrasive and polishing agent, and also in the charging of circular saws and lap wheels used for grinding purposes. It is marketed by the metric carat (5 carats equal 1 gram). The May, 1942, price was unchanged from that of 1941, $1.50 to $1.75 per carat. Shipment is usually by registered mail or insured parcel post. While there are a number of different grades, there are no fixed price differentials. There is no import duty. While diamond dust is very important in war production, and consumption has increased, supplies early in 1942 were regarded as ample.

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Diamonds

THIS gem has for centuries been the most popular of the precious stones. Volume of sales varies with financial depressions and booms and it has been a favorite medium of investment in times of political crisis. Diamond cutting originated in India, where diamonds were first discovered, certainly well over a thousand years ago, and to Hindu lapidaries we owe the two basic principles of the art—the wheel and the use of diamond dust. Several centuries ago European partisans wrested the cutting supremacy from the far east and surpassed their eastern confreres in skill. Cut stones appeared in Europe between the eighth and thirteenth centuries. Diamond cutting appeared on the Western continent in Brazil in 1802, and in the late sixties of the last century a cutting industry sprang into being in the United States. The art of cutting has made a steady improvement, slow at first but thereafter marked, particularly in our generation.

An adequate supply of rough diamonds is necessary to the growth of the art. The Indian mines created the ancient industry and with their decline the industry died. Cutting in Borneo was fed from local mines but is now supplemented by imported South African rough. An ancient industry, the secrets of which were carefully guarded until sixty years ago; once a home industry, taught by father to son, it is now carried on in factories. Started as a family trade, it has become big business.

The United States imports cut diamonds principally from Belgium and the Netherlands, in normal times—while the rough dia-

monds although originating in South Africa are imported in the greater part from England, purchased at sights of the Diamond Trading Company held in London.

The war brought a radical change in the cut-diamond trade. Britain arranged to obtain stones from the Belgian Congo for sale and distribution through London. Brazil reported (in 1941) heavy buying by Axis powers. However, last year diamonds were included in the list of strategic materials specified in the agreement between the United States and Brazil, according to which the United States would purchase all of Brazil's output for the next two years, any surplus after the regular American buyers have made their purchases to be bought by the United States Government. A good part of Brazil's output is bortz diamonds (see diamond dust). Last year, when Axis powers were outbidding others for Brazilian diamonds, the average price ranged about $25 a carat including bort while prices of $50 a carat were obtained for one-carat stones and $60 a carat for two-carat stones.

The War Production Board by Order M-109, effective March 27, 1942, required that all persons who, on March 31, 1942, had in their possessions or have title to 10 carats or more of rough diamonds are required to report them to WPB. Sales, transfers and imports of rough diamonds also must be reported. The Order does not apply to cut or polished diamonds used as gems nor to rough diamonds incorporated in a tool for use, but diamonds in unused tools must be reported.

During the first nine months of 1941 there were 182,652 carats of cut diamonds imported at a value of $13,570,481 and 124,202 carats of rough valued at $5,967,938.

In 1940, United States imports of rough or uncut diamonds (suitable for cutting into gem stones) totaled 227,886 carats valued at $11,595,703 while cut, but unset stones, dutiable, amounted to 54,005 carats valued at $5,457,151 for "less than 10 stones per carat" and 267,466 carats valued at $16,544,568 for "10 or more stones per carat." In 1940 the Diamond Trading Co., which controls the sale of about 95 per cent of the world output of diamonds, sold rough stones valued at about $25,000,000 but with the invasion of the Low Countries, trade fell off and the United States became the chief customer. The war disrupted 90 per cent of the diamond cutting industry. In 1941, there were about 1,600 cutters (including apprentices) in the United States and Puerto Rico; 408 in South Africa; 250 in England; 200 in Cuba and approximately 400 in Palestine.

World production of diamonds in 1940* was estimated at 14,140,200 carats (gem and industrial) valued at about $31,000,000 —an all time record as to quantity but not as to value. Production of bort increased markedly while that of gem stones was off by about 25 per cent. Belgian Congo was the leading producer (77 per cent in weight and 24 per cent in value). Increased Belgian Congo production was principally of bort.

Estimated 1941 production was 9,345,076 carats valued at $28,000,000 — weighing 1.869 metric tons.

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Dibutyl Phthalate

DIBUTYL PHTHALATE is an oily liquid. It is produced by reacting normal butyl alcohol with phthalic anhydride, followed by purification by distillation. The product is usually free from color and odor, and 99 to 100 percent pure. It is miscible with the common organic solvents, such as acetone and ether, and is very slightly soluble in water.

Production of dibutyl phthalate in 1940 totaled 8,799,528 pounds, and sales 5,506,098 pounds valued at $947,658. Six producers were recorded for the year. In 1939

production amounted to 7,923,771 pounds; and sales 5,661,733 pounds, valued at $942,-134, from the same number of producers. Commercially, dibutyl phthalate is packed in boxed cans holding one and 5 gallons; and 5, 10, 50, and 100-gallon steel drums.

Most important of the uses of dibutyl phthalate is as a plasticizer in nitrocellulose lacquers and plastics. It also is used in the production of safety glass, as a solvent for perfume oils, as a perfume fixative, textile lubricating agent, resin solvent, and in leather dopes, insecticides, and printing inks. The price of dibutyl phthalate on June 1, 1942 ranged from 20 to 22¢ per pound. At the start of 1942 and 1941, it was priced at from 18 to 20¢ per pound.

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Dichromates

See Bichromates

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Dihydroxysuccinic Acid

See Tartaric Acid

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Dill Oil

DILL, or dillseed oil is a pale yellow oil with a penetrating odor obtained by distillation of the fruit of Anethum graveolens. A dillweed oil, similar to the seed oil, is also known in commerce. Considerable dill is cultivated in Germany and Holland for oil production. The East Indian area was also an important supplier of the seed in the years preceding the war. Dillweed oil, produced by distilling the weed itself, is made in this country and in England in small amounts. They are packed in 25-pound tins.

The use of the dill oils is principally in flavoring. Certain perfume combinations also contain small quantities. On June 1, 1942, dillseed oil was priced at $8.00 per pound, while the weed oil was slightly lower. Prices were between $7.00 and $7.50 per pound for both dill oils at the beginning of 1942; while at the same time in 1941 dillseed oil was offered at from $4.50 to $5.00 per pound, and dillweed oil at from $5.00 to $5.75 per pound.

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Dimension Slate

See Slate

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Dipentene

See Turpentine and Rosin

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Distilled Spirits

AS THIS analysis was being prepared (June 1942) the distilled spirits industry was undergoing a rapid conversion to a war basis. All plant facilities were being changed over to produce high proof alcohol primarily for war purposes and subject to allocation by the War Production Board. There was marked difficulty in the use of alcohol for gin and blended whiskey. However, stocks of whiskey in bonded warehouses at the time approximated 520 million gallons. In addition, there were 15 million gallons on hand which included brandy and rum. It was estimated that these stocks were sufficient to supply at least three years' requirements unless conditions changed rapidly. The industry was able, accordingly, to meet all demands for distilled spirits with the exception of gin.

The packaging of distilled spirits also changed owing to the shortage of tin and terneplate for closures. The War Production Board specified a standard bottle for half pints, pints, fifths and quarts as soon as current stocks of glassware were consumed. This put an end to individual packaging.

The following description of the distilled

spirits industry thus applies to conditions as they existed prior to the entrance of the United States into the war.

The domestic distilled spirits industry may be generally classified into four main groupings or categories, namely, whiskey, gin, rum and brandy. Wines and beers, being fermented alcoholic liquors, are classified separately and are not treated in this article.

The manufacture of whiskey is by far the largest in volume and economic importance. Whiskey is broadly classified as straight whiskey, blends or mixtures of straight whiskies and blends of straight whiskies with neutral spirits, or distillates which are principally ethyl alcohol without charasteristics due to their particular grain or other fermentable material origins.

The Alcohol Tax Unit of the Bureau of Internal Revenue enforced detailed requirements as to labeling of spirits in interstate commerce. These regulations are designed to furnish the consumer with adequate information as to the character of the commodity.

The principal grains used in whiskey production are corn and rye. Between 65 and 70% of the total volume of consumption has as its main constituent corn grain and is classified in the industry as bourbon whiskey. The remainder, about 30%, has rye grain as its main constituent and is known in the industry as rye whiskey. A small amount of whiskey made from wheat and malted barley has been manufactured, but is of slight economic or trade importance.

Bourbon whiskey is generally produced in the states of Kentucky, Ohio, Indiana and Illinois and rye whiskey in the eastern states, principally Maryland and Pennsylvania. There is no whiskey production of importance in the far west or far south, although a few small plants are operating in those sections. It is a regional industry as far as manufacture is concerned but a national industry insofar as distribution is concerned.

Whiskey that has been stored in a United States Internal Revenue bonded warehouse for a period of not less than four years may be "bottled in bond" at not less than 100 degrees proof. "Proof" is a measure of the alcoholic content of distilled spirits. Each degree of proof is the equivalent of ½% of alcohol by volume. Therefore, when it is stated that a whiskey is 100 degrees proof, it means that its alcoholic content is 50%, the balance being water with a small quantity of flavoring constituents. Ninety proof means that the spirits contain 45% of alcohol by volume. United States proof should not be confused with British proof. The latter is based upon a different standard of measurement.

Just as the characteristics of certain brands of whiskey differ, so do the formulas and production techniques which produce them. With some of America's better known nationally advertised brands, these formulas are precious family secrets—family possessions that have been handed down through several generations from father to son.

However, while certain distinctive individual steps and methods are peculiar to individual brands, for purposes of our discussion here we may roughly divide whiskey-making into four general steps, namely:

1. Conversion of the starch in the grains into fermentable sugars.
2. Fermentation of these sugars for production of alcohol.
3. Concentration of alcohol by distillation.
4. Maturing by storage in charred oak barrels.

These four steps each consist of a number of delicate procedures and embrace some very complicated chemical changes.

Whiskey is differentiated according to its geographic origin, the raw material used in its preparation, and its classification by types.

RYE. The American whiskey industry in

its beginnings used only rye grain in the preparation of the mash. It even relied on the small amount of diastase which is always present in the raw grain for the transformation of starch into sugar. Of course, the yield obtained by such primitive methods was very low and the product required considerable time for maturing. More modern methods use barley or rye malt in the production of "pure" rye, about one-fifth of the malted grain being mixed in with the rye.

While the "pure" rye whiskies contain, as above mentioned, only rye and the necessary malted grain, other rye whiskies are being produced which contain a certain amount of corn. Under present FAA (Federal Alcohol Administration) regulations, a whiskey, to be classified as a rye whiskey, must be distilled from a mash composed of not less than 51% of rye grain.

"Modified" rye, containing a certain portion of corn, matures somewhat more quickly than pure rye. The heavy characteristic flavor of the pure rye is not quite as predominant and a great many consumers prefer a rye of the modified type.

Choice of the grain is very important and greatly influences the final quality. Wisconsin and Michigan rye grains are usually given preference in the making of the finest rye whiskies.

BOURBON WHISKEY is produced from a mash containing not less than 51% of corn grain. In most instances, bourbon mash is prepared not only with corn and the necessary barley malt, but there is also an added quantity of rye which varies from as little as 2 or 3% to as much as 30%.

CORN WHISKEY is as a rule distilled from a mash containing more than 80% of corn and often as much as 90%. As a rule, no rye is used in such a mash. This type of whiskey is ordinarily not matured in charred oak and for this reason it is colorless to pale yellow.

MALT WHISKEY. At least 51% of the grain must be malted barley or malted rye. As a rule the mash is prepared entirely from malted grain and only a very small percentage of unmalted rye is added. Most malt whiskey must be matured for from 5 to 6 years. It is very heavily flavored and ordinarily not used as a straight beverage, but rather for blending purposes.

Straight whiskey is an alcoholic distillate from a fermented mash of grain distilled at not exceeding 160 proof and withdrawn from the cistern room of the distillery at not more than 110 and not less than 80 proof, whether or not such proof is further reduced prior to bottling to not less than 80 proof and is stored in new, charred barrels for a period of at least two years prior to bottling.

Blended whiskey (whiskey—a blend) is a mixture which contains at least 20% by volume of 100 proof straight whiskey, and separately or in combination, whiskey or neutral spirits if such a mixture at the time of bottling is not less than 80 proof.

SCOTCH WHISKEY is a blend of malt and grain whiskies which have been prepared by methods used only in Scotland. The following description of the manufacture of Scotch Whisky by the pot still method may be taken as applying more or less closely to all the Highland distilleries.

Scotch whisky is made primarily of barley. The grain is first thoroughly moistened. After it has softened and germinated (called "malt" after this process), it is sent to the kiln where it is dried. A fire of peat is set under the kiln, which has a floor of wire mesh, and the smoke of the peat fire passes through and saturates the vat barley. The distinctive peaty, smoky flavor of Scotch whisky is acquired during the drying process, which takes about three days, as the barley absorbs the tang and flavor of the peat smoke.

Then the peat smoke flavored malt is ground, mixed with water, and the waste

matter drained off. The mass is fermented with the aid of a small quantity of yeast, changing the sugar content into alcohol.

The liquid is poured into stills, brought to a boiling point by coal fires, and distilled.

The raw whisky is run off into casks and allowed to mature. Scotch whiskies may be blended either before maturing, after a period of maturing has taken place, or just before bottling. The blending of Scotch whiskies consists in mixing together various whiskies of different types and ages so that the resultant product will have all the desired qualities of smoothness, mellowness and richness of a given brand.

IRISH WHISKEY is a malt whiskey made in Ireland. Preparation of the grain and distillation are similar to the Scotch method. The main difference lies in the fact that the malt in the production of Scotch is thoroughly saturated by the smoke from an open peat fire, while the malt in Irish is dried over a closed coal fire. Consequently, Irish does not have the smoky tang which is characteristic of Scotch whisky.

CANADIAN WHISKEY. Canadian regulations regarding bottled-in-bond whiskies are somewhat different from those imposed by the United States Government on domestic whiskies. For example, Canada permits bottling-in-bond at 90 proof, whereas the United States standard is 100 proof. Another permits Canadian distillers to use grain spirits to replace loss by evaporation and soakage into the barrel—a substantial amount over a period of years. There are other conditions permitted in Canada which allow the manufacturers of "Canadian type" whiskey much greater leeway in production methods. However, "American type" whiskey made in Canada and admitted into this country as such, must have been produced according to the rigid American standards.

The art of making Gin consists first: in selecting and combining the proper ingredients, and second, in controlling the actual distillation operation by properly regulating various conditions, especially the temperature at which the still is operated, so as best to extract the desired flavors from the ingredients. If the temperature is held too low, not enough of flavor of the oils is imparted. If the temperature is raised too high, or if the operation is carried on for too long a time, the berries and herbs will give off flavors which impart very undesirable properties to the product.

The ingredients generally used in producing gin are the following:

Juniper berries	Caraway seed
Coriander seed	Calamus
Cardamon seed	Cassia bark
Angelica Root	Fennel
Anise seed	Orris Root
Bitter almonds	Licorice

Sweet and Bitter Orange Peel

Extraction out of all these ingredients of just the desired amount of flavor is the art of the gin distiller.

In gin distillation, like any other process of this kind, the beginning and the end of a run are likely to have some undesirable qualities. The judicious cutting of these "heads" and "tails" constitutes another important factor in the manufacture of Gin.

Rum is in its largest definition an alcoholic beverage distilled from fermented saccharine materials. Specifically, nowadays rum is understood to be made from sugar cane, or its derivatives such as molasses. Rum can also be made from sugar beets, sorghum agave, cactus or any other plant containing saccharine juices. Such rums would, of course, have distinctive flavors.

Under government regulations, none of these latter materials are recognized, and only cane sugar either directly or in its derivatives will produce genuine rum.

There are two distinct types of rum, the so-called Island rum and the New England rum. The best known sources of Island rum are Cuba, Jamaica, Martinique, Virgin

Islands, Trinidad, Haiti, St. Domingo, Barbados, Demerara and Puerto Rico. On the "Islands," most rum is made from sugar cane. New England rum, as distilled in the United States, is made from molasses.

The production of brandy in the United States falls generally into two classes, namely, apple brandy in the east and grape brandy in the middle west and far west. A small industry has been developed in the south in the production of brandy from peaches and citrus fruits, but so far the results have been disappointing economically.

The production of apple brandy or applejack in the east is seasonable and is attendant upon the commercial apple crop. Applejack is a staple in many of the eastern states and while it does not approach in volume the whiskey production of the same states it still has a steady market. It is produced largely in the fall or early winter when the current apple crop is brought to market. It is also true that apple brandy is produced to a certain extent throughout the year from hard cider or refrigerated apple pomace. The great bulk of the applejack, however, is produced from middle fall to early spring.

Applejack is stored in barrels, either newly charred or reused barrels, and matures in a little bit shorter time than whiskey distilled from grain. A small quantity of applejack has been stored in barrels for over four years and has then been bottled in bond. It is a very fine product and while its market is somewhat limited, it is a very distinctive American product.

The grape brandy production is very largely centered in California where it is an adjunct to the domestic wine industry. Some very fine domestic brandies are produced in California.

As defined by the FAA, brandy is the distillate obtained solely from the fermented juice or mash of fruit. It is distilled at less than 190 proof (whether or not such proof is further reduced prior to bottling to not less than 80 proof) in such manner that the distillate possesses the taste, aroma and characteristics generally attributed to brandy; and includes mixtures solely of such distillate.

Today in America brandy-making, like whiskey-making, is a large scale scientific enterprise in which each delicate step is carried out under the direction of laboratory technicians.

From the time a vineyard is first planted, approximately five years are necessary for the growth of a healthy vine and root system. The vines are scientifically pruned each winter to insure that sunshine and air will reach all productive parts. Harvesting begins in the fall.

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Dogfish Liver Oil

See Fish Liver Oils

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Dolomite

See Lime

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Douglas Fir

SECOND in importance to Southern Pine in United States lumber production is Douglas Fir, which constitutes about 25 percent of the total lumber cut.

It is classified as a softwood and is sometimes called Oregon Pine, Douglas Pine, Red Fir, Fir, Douglas Spruce, or Yellow Fir. The trees grow to heights of 100 feet and more and are valued for construction work where large timber is required. The wood of the younger trees is reddish brown while the older trees yield a yellowish brown colored wood. While Douglas Fir averages lighter in weight, strength and toughness than most southern pine varieties, it exceeds some in

strength and toughness even where the density is less. It is less resinous than pitch pine.

In 1940, 7,121,236 thousand feet board was reported cut out of a total lumber cut of 28,934,127. The state of Washington was credited with a cut of 3,509,266 thousand feet board while Oregon supplied 3,251,187, the two states mentioned accounting for 95 percent of the cut.

Maximum prices for Douglas fir were first fixed by the OPA on September 11, 1941. A complete revision of Price Schedule No. 26 was made, however, on June 16, 1942. The price schedule covers a long list of grades and specifications.

Under War Production Board's Order L-121, made effective May 13, 1942, and since revised, restrictions are placed on the sale, shipment or delivery of Douglas fir of certain grades and specifications. In addition, WPB by Order L-150 made effective June 15, 1942 placed limitations on the manufacture and delivery of certain types and sizes of Douglas fir plywood. Maximum prices for plywood have been in effect since Aug. 5, 1941, and on Douglas fir doors since Dec. 10, 1942.

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Earth Wax

See Ceresin

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Ebony

EBONY is a tropical wood, next to lignum vitae in hardness, with a fine open grain and a weight of about 78 pounds per cubic foot. It is cut in the forests of West Africa, principally in the Caboons and Congo regions. Imports in 1941 due to the war were but 25 tons from the Congo. Ceylon produces small quantities as does the Netherlands Indies. Imports from those areas respectively in 1941 were about 50 tons and 200 tons. It is valued for parts subject to intensive wear and for inlaying. It is used for furniture border strips, in cabinet work, for novelties, cutlery, handles, etc. It is marketed by the long ton. Prices, recently, have averaged (for African and Indian woods) about $150.00 per ton ex-dock and for Macassar (from N. E. I.) about $110.00, ex-dock. It is not perishable over a period of three to four years. Two principal grades are: "Good Merchantable" and "Veneer Quality." There are no substitutes, although an artificial ebony has been marketed, usually molded from synthetic resins.

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Eggs

ALTHOUGH the eggs of all domestic poultry are considered edible products, it is estimated that about 99 percent of total production in the United States comes from chickens. Hence, the following discussion concerns itself with the eggs of the chicken.

The number of eggs produced each year is determined by a combination of natural and man-controlled factors.

The most important natural factor reducing output is adverse weather in the form of summer droughts or severe winters. Severe winters not only limit the rate of lay but also handicap the movement of supplies to market. Blizzards blocking country roads sometimes result in temporary shortages of fresh supplies in large city markets.

Farmers' reactions to a number of price relationships also have important bearing on the size of the output. High feed costs relative to egg prices tend to stimulate culling of flocks and restriction of food allowances per bird. More attractive cash returns from poultry than from eggs influence the marketing of layers. Beginning in 1925 a three-year cycle in the number of chickens raised can be observed.

A steadily rising trend in output per layer as well as declining production costs have resulted in recent years from an in-

creasing knowledge of breeding and more intelligent care of birds. Particularly conspicuous have been sharp gains in winter laying efficiency, aided partially by artificial lighting practices.

Government price supporting operations through purchases of surplus goods during the last few years of heavy marketings have been a factor stimulating output. Lend-lease purchases of egg products in 1942 influenced a record high level of production in that year.

Although egg production is continuous throughout the year, there is a definite seasonal pattern to the volume. About 50 per cent of the annual supply is produced in four spring months, March through June. The ebb point of the flow from the nation's nests occurs in November.

The problem of supplying the consumer with a fairly constant flow of eggs throughout the year, in spite of the fact that production is bunched primarily in four months, has been met by the utilization of cold storage refrigeration. About 20 per cent of the spring output is stored for withdrawal chiefly from early September through December. Stocks of shell and frozen eggs ordinarily reach their peak about August 1.

Middlemen determine approximately how many eggs will be needed during the lean months and grade out better quality spring eggs for storing. Eggs are held in warehouses under closely controlled conditions of temperature and humidity. Some eggs are given special treatment before storing by some type of oil-dipping process, by which the pores of the shell are sealed, vastly improving the keeping quality.

Although eggs are produced in every state, the bulk of domestic supply comes from the North Central states. The leaders in production are Iowa, Ohio, Texas, Pennsylvania, Missouri, Illinois, Minnesota, Wisconsin, New York, California, Kansas, Indiana, Michigan and Nebraska. Production in 1941 totaled 3.4 billion dozen and the goal for 1942 was 3.8 billion dozen.

The primary uses of eggs are as a foodstuff or as an ingredient in the preparation of foodstuffs. The portion of the egg supply made into frozen eggs is utilized by commercial bakers, manufacturers of candy, confectioneries, salad dressing and the like. Something less than 3 percent of the total egg supply is bought by hatcheries or held back by farmers for replenishment of flocks. Liquid and dried egg products constitute the form in which most eggs are exported since they have better keeping qualities and are less bulky than shell eggs. Eggs have a high nutritive value. Like meat their protein content is high, and, like milk, they contain most of the essentials for growth and repair of body tissues. Whether eaten raw or cooked, eggs are almost completely digestible and so are frequently prescribed for children or under-nourished persons.

The marketing unit is the dozen. The price in Chicago early in June 1942 was 30¾¢ per dozen (extras, first).

About 60 percent of the receipts at Chicago are by truck, the balance primarily by rail, though some come via parcel post and express. On the other hand, arrivals at New York are about 80 percent by rail and boat and the remainder largely by truck. Chicago receipts come largely from Iowa, the nation's No. 1 egg producing state, from Wisconsin, Minnesota, Illinois, Mississippi, Nebraska and South Dakota. New York gathers her supplies from a much larger area including, in important measure, most of the Midwestern states which ship to Chicago.

The development of refrigerated trucking diverted traffic which was formerly carried chiefly by railroads and tended to decentralize warehouse and distribution operations.

In its natural state the egg is a perishable product, but proper handling and storage will enable it to keep for many months. Eggs stored in the spring and summer are con-

sumed in the following fall and winter. Eggs laid in the spring keep in storage much better than the summer eggs.

Great quality variations between eggs has resulted in the practice of grading. A number of different authorities promulgate standards. Large wholesale markets, such as Chicago or New York or San Francisco, influence grading practices over wide areas. Adopted a few years ago and coming into increasing usage are United States Department of Agriculture specifications, denoted in a series of U. S. wholesale and U. S. retail grades. Various state-enacted standards are falling into disuse.

General factors determining quality are the size and weight of the egg, condition and shape of shell—whether clean and sound or dirty and cracked—and the nature of the contents as indicated by the color and mobility of the white and yolk. The device of candling—holding the individual egg before a small beam of light—discloses the grade of egg to the expert candler.

The most important quality determinant is the handling the egg receives after it is laid, although good feeding practices and healthy, superior breeds of flocks contribute to the marketing of better eggs. Exposure to heat or extreme cold, dryness, changes in temperature, or extended retention without refrigeration quicken the deterioration of even the best eggs.

Leading grades in the Chicago market are: Extras, firsts; graded firsts; current receipts; dirties; checks; storage packed extras; storage packed firsts.

The duty on eggs in the shell is 10¢ a dozen and 5¢ a dozen from Canada.

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Electric Power

THE great industrial section of the United States lies east of the Mississippi and north of the Ohio River, but the greatest water power reserves are found in the Northwest, Pacific Coast and Southeastern sections. Hence the North Central, Middle Atlantic and New England states must rely largely on steam stations for their power.

Location of steam power stations is largely determined by three things — load center, fuel, and water. The fuel, whether coal, oil, or gas, must be cheap and ample, and the supply of condensing water must be large, of good quality, and close to the site.

It has often been proposed that location of steam generating stations at or near the coal mines would be more economical. But in producing electrical energy by steam, huge quantities of water are needed. The condensing water necessary for modern steam generating stations varies from about 400 to 500 tons of water for every ton of coal burned. It is not consumed but is used for condensing purposes and then returned to the source of supply. Sufficient water is seldom available near the mines. Where it is, and the distance from load center is not too great, steam stations have in most cases already been built. Construction of additional generating stations at or near the coal mines must wait on increased transmission efficiency.

Central steam stations have to keep on hand at all times considerable supplies of coal to guard against interruptions in the coal supply. This involves large investment in land and the handling and rehandling of thousands of tons of coal annually.

The art of steam generation has made tremendous strides in the last twenty years. Forty years ago six to eight pounds of coal per kilowatt-hour were needed. At present the newest stations use less than a pound per kilowatt-hour. In many cases steam power costs are lower than water power developments unless the latter are exceptionally attractive. In fact, great steam generating stations have even been consructed adjacent to great water powers, as in Buffalo,

New York, only twenty miles from Niagara Falls. Many electrical transmission systems were originally built near water power, using steam standby plants for transmission line interruptions and during seasonal lower water and in case of drought. So much faster has steam generation progressed that systems of this sort which once used 75% water power now use only forty or fifty per cent, and the rest is made by steam.

Despite the improvement in steam generation, a steam plant still uses only about 30% of the energy in its fuel. By contrast hydro-electric plants already use some 75 to 90% of the available power energy in the water. A ton of water must fall one mile to equal the energy contained in one pound of coal. For this reason the possibilities of further economy and improvement in steam generation still are greater than in hydro development.

For these and other reasons the further development of power in this country is likely to continue to be in the form of steam plants rather than hydro. These are among the reasons which led Thomas Edison to say in 1929 that "steam power is business, hydro power is politics."

The first electric current, whether generated by steam or by water power, was all direct current and could be transmitted only short distances. The development of alternating current made possible the transmission of power over longer distances.

Present generating capacity of the United States is approximately 12,750,000 kilowatts of water power and 32,500,000 kilowatts of steam power including internal combustion. Practically all the additions to the nation's hydro-electric power in recent years have been made by governmental bodies, including in particular the Tennessee Valley Authority, the Pacific Northwest Authority, and the Colorado River Authority. When finally completed the Grand Coulee Dam is expected to add approximately 1,500,000 kilowatts to this total. Development of the International Rapids in the St. Lawrence River, if eventually decided upon, will provide approximately 1,640,000 kilowatts, half for the United States and half for Canada.

The power rating of a dam must be stated in two ways—the "firm power," which is the maximum power which can be depended upon at the lowest water, and the maximum power available at high water. "Firm power" is usually sold at substantially higher rates because it can be depended upon, while the extra power available only at high water, can only be sold at "dump rates" which take into account the fact that it cannot be depended upon and may be available at times when it is not saleable except at specially low prices.

Reports of the U. S. Geological Survey indicate that more than 75% of the country's undeveloped water power is in the Pacific, Mountain, and South Atlantic states which contain less than 23% of the population.

Cost of water power construction is generally several times larger than that of steam power. After improvements in the arts in recent years, the investment needed per kilowatt of capacity in water power is roughly estimated at from $150 to $300, per kilowatt of firm power, against approximately $75 for the best steam plants. Moreover, from 70 to 90% of the cost of delivering electricity to the domestic consumer is incurred after the power has left the generating station. Water powers are often located many miles from the load center, and as much as 15% of the power may be lost in the long-distance transmission.

The importance of this difference in the size of initial investment is multiplied by the unusual ratio in the electric power industry of investment to sales. It is in general estimated that the investment in a power plant is equal to about *five years'* gross revenues, or total sales. Thus it takes an investment of about $5,000,000 to obtain $1,000,000 a

year of sales. This contrasts sharply with the ratios for most industries. Many manufacturing companies, for example, have gross sales every year as large as their total plant account, while organizations engaged primarily in distribution, like mail order houses, department stores, and chains, may report annual sales several times larger than their total plant account and net current assets.

This high ratio of "plant account" to current sales in the electric power industry is of more than mere bookkeeping interest for numerous reasons. Principal one is that a much larger proportion of the cost of power installations has been obtained by borrowed money than of the cost of ordinary industrial plant. This in turn is due to several reasons. In the first place, the business has grown so rapidly that there has not been time or available income for it to be built up out of reinvested or "plowed in" earnings. Secondly, by the nature of the business, sales have been sufficiently stable and the market for power sufficiently reliable so that it has been safe to maintain a larger proportion of indebtedness to plant than in manufacturing industry. This, in fact, has led to more consistent reductions in the price of power than have been made, by and large, in industrial products. Lastly, for a considerable proportion of its business, at least from 25 to 50%, the electric power industry has been granted legal monopolies.

An electric power company's rate schedule is necessarily very complex. When Thomas Edison opened his Pearl Street plant at New York City, service was offered to the first 59 customers for several months without any billing, pending study and adjustment of what should be considered reasonable charges. The energy was all used for lighting and there was but a single class of customers. So the first meter rates were straight line rates at so much per kilowatt hour and the making of rates was little influenced by theory.

From there on, however, numerous considerations began to introduce a steadily increasing, but unavoidable complexity into electric power rates.

In the first place, the power company sells not only the power itself, but the ability to supply it. This is another way of saying that overhead costs have to be more directly embodied in prices than in industries where the product goes directly into competitive channels or can be accumulated for sale at convenient times. There is no manufacture for inventory. Electric service must be delivered to the customer in whatever quantity is desired at the very moment the switch is turned. The whole sequence from production to consumption is instantaneous. Thus, certain customers may want a large amount of energy at a certain time and at that time only. The cost of building a plant to supply this power is much greater than the cost of building a plant to supply the same total amount of power distributed over a whole day, month, or year. A single kilowatt hour supplied for every hour in the year costs less than 8,760 kilowatt hours supplied during a single hour. The peak load of the year, for instance, comes usually on December 21, the shortest day of the year, in the afternoon and evening when office lights are still on and street-cars are using power to take people to their homes, where the lighting load has also approached its peak. Peak loads are also noted during Christmas week due to lighting of trees. Additional loads at such time would require extra plants whereas additional loads in the middle of the night, when demand from factories, offices, transportation, and residences is small, costs nothing in extra plant and puts the power company out of pocket only for the extra coal—a comparatively small item compared with interest, depreciation, labor, and taxes.

This factor caused power rates to be based on a theoretical allocation of costs between

standby or service charge, and per-unit charges. This is why residential rates are the highest for the first few kilowatt hours, and why special rates are made for off-peak service and for power sold in small steady blocks rather than for quick, heavy consumption.

A second consideration is the fact that the selling price of electricity has to include, unlike the price of most commodities, the cost of delivery. This cost may be very high for residential service and very low for industrial service. Ten thousand kilowatt hours sold for consumption in an electric furnace will require only a small fraction of the investment in distribution lines required for the same amount sold in the same time for residential consumption.

Lastly the industry has from the beginning had to take into account at least to some degree the principle of "ability to pay," or "value of service rendered." When street lighting came in, power was sold at unit prices per lamp per year, but the unit price was lower than for home or office lighting, and then "wholesale rates" came into use for industry, set low enough "to get the business."

To cite extreme examples, certain branches of heavy industry require enormous quantities of power, such as the manufacture of certain chemicals, and of aluminum, fertilizer, and cement. They could not buy these quantities unless the rate was made extremely low. On the other hand if the power company makes the rate low—but not too low—its own costs are reduced by the reduced costs of billing, the smaller costs of delivery, and by more nearly capacity operation of its plants in off-peak hours. It was found in some cases that heavy wholesale rates nevertheless contributed sufficiently to overhead so that the comparatively higher-priced residential rates could be further reduced.

Electric power rates to residential consumers have for a generation been regulated by most states. Against political pressure the courts have held that the companies are entitled to rates high enough to guarantee them a "fair return" on the value of their investment. This does not mean a fair return on their capitalization. The determination of actual investment has therefore become a highly controversial point which has at times gone off into abstruse legal and accounting theories while the actual making of rates has been held down to reasonable levels by the possibilities of industrial self-servicing in power, and by the fact that, within limits, lower rates means a larger volume of business. Political pressure has also on many occasions forced laggard managements into offering lower rates, though it should be said that the trend has been away from municipal ownership of power systems except where they have been federally subsidized, and many municipal and federal power systems are now exempted from the accounting requirements and taxes imposed on private companies.

The increase in industrial activity, which has accompanied the war program, has been reflected in a considerably enlarged demand for electricity. Sales of industrial power in 1941 were 27½ per cent above the previous year. Total power output for all uses was up 16 per cent.

Despite increasingly heavy demands being placed on national generating capacity, it has thus far proved ample for the highest peak loads. Large new installations under way give assurances for the future of an adequate power supply, except perhaps in isolated locations.

Scheduled new capacity to be installed in 1942 and 1943 will amount to an additional 5,000,000 kilowatts.

* * *

Elm

See Hardwoods

Emery

A FINE grained variety of corundum, containing other minerals, chiefly magnetite, emery has been largely displaced as an important abrasive by synthetically made aluminum oxides. It has a hardness of about 8 and is marketed either ground into powder or in the form of blocks or wheels. The grains are also glued to one side of paper or cloth sheets.

Sales of emery in 1940 in the U. S. rose to 1,046 short tons valued at $9,349—37 percent greater in both tonnage and value than in 1939. As in former years, production was reported from but three producers —all in the Peekskill district of New York. At the same time, production of aluminum oxide (an artificial abrasive) amounted to 98,000 tons in 1940—an increase of almost 100 percent above the previous year.

In 1940, imports of emery ore totaled 5,718 short tons against 2,191 tons in 1939.

The Minerals Yearbook reported that the competition of artificial abrasives and imported emery and corundum has caused a general downward trend in the demand for domestic emery since the World War I. From 1933 to 1939 sales were only a few hundred tons per year, and in 1938 failed entirely. A temporary revival in domestic sales occurred in 1928 and 1933 following curtailment of imports of emery and corundum.

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Ephedrine

EPHEDRINE is an alkaloid obtained by extraction from the stems and leaves of Ephedra plants, especially the Ma Huang found in China and India, or produced synthetically. The alkaloid is in the form of unctuous, white or light colored granules or pieces, only occasionally crystalline. It is hygroscopic, and must be protected from moisture and stored in a cool place. The aqueous solution of ephedrine is quite alkaline. It is also soluble in alcohol, ether, and fixed oils.

Production of ephedrine in the United States during 1939 from natural sources amounted to 403,237 ounces, valued at $593,778. Figures are not available as to the amount of synthetic ephedrine produced by the two manufacturers of the material. Commercially, ephedrine is packaged in bottles containing 16, 4, 1, ¼, and ⅛ ounces.

Ephedrine is used in medicine in the treatment of hay fever, asthma, circulatory failure, and narcotic poisoning. It is official in the United States Parmacopeia. The price of natural ephedrine on June 1, 1942 was $1.15 per ounce, while the synthetic material was 65¢. These prices were also in effect at the start of 1942. On January 1, 1942, the price of the synthetic, anhydrous material was 85¢ per ounce.

In addition to the basic alkaloid, an ephedrine hydrochloride and ephedrine sulphate are also used in medicine. The hydrochloride contains an equivalent of 80 to 82.5 per cent of anhydrous basic alkaloid; and the sulphate contains an equivalent of 75.5 to 77.3 per cent of the anhydrous alkaloid. The salts are sold in crystalline and powdered forms in the same sized packages as the alkaloid. Their use is similar to the parent product.

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Erbium

See Monazite

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Erigeron Oil

ERIGERON OIL is also known as fleabane oil, horseweed oil, and butterweed oil. It is pale yellow, darkening on exposure to air, has an aromatic odor and pungent taste, and is obtained by distilling the fresh flowering herb of Erigeron canadense. The spe-

cies is abundant in the northern and middle sections of the United States and Canada, and is often an undesirable weed in peppermint cultivation. The oil is frequently distilled by those engaged in peppermint oil production.

In commerce erigeron oil is packed in tin cans containing 20 pounds. It finds its chief use in medicine, particularly for its antiseptic qualities. On June 1, 1942, the price of erigeron oil was $2.20 per pound. At the start of 1942, it was $2.25; while at the same time in 1941 it was $2.00 per pound.

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The Essential Oils

THE essential oils are the fragrant, sometimes aromatic compounds of an oily nature formed in plants, and are responsible for the characteristic odor of the flower or other portion of the plant in which they are found. They are also known as volatile oils, or less often, as ethereal oils. All are mixtures of natural origin, varying widely as to both the number and type of constituents. The usual types of chemical compounds going into their composition are terpenes, esters, aldehydes, ketones, ethers, and alcohols. Synthetic mixtures have been developed duplicating certain of the natural essential oils.

The physical constants of specific gravity, refractive index, and optical rotation are most important in the identification of essential oils. However, the odors, either of the nature or diluted oils, govern their exact commercial value. Adulteration, when practiced, may be accomplished by diluting an expensive oil with a cheaper oil or with products resembling the former.

Essential oils are obtained from the natural products in which they occur by a number of methods, depending upon the nature of the oil. Most important are steam distillation and expression. Steam distillation is accomplished by distilling the macerated flower or other plant part with steam. Expression is practiced in the citrous oils principally, where the fruit rinds are squeezed between rollers. Both hot and cold expression are practiced, the latter producing the higher quality oil. Solvent extraction is also employed in certain cases. For the most delicate odorous materials, the process of enfleurage is used, in which the plant parts are spread upon a thin layer of odorless fat. The fat absorbs the fragrant exhalations, and subsequently the charged fat is treated with a suitable solvent to separate the desired odorous material.

The production of essential oil raw materials in this country is being actively promoted at present by the National Farm Chemurgic Council and various industrial interests. Among the aromatic plants suggested for introduction are coriander, anise, fennel, angelica, licorice, caraway, and sage. The economic possibilities for such cultivation are declared to be encouraging, since soil and climatic conditions in the United States are favorable over wide areas. Currently only three aromatic plants—mint, wintergreen, and citrus — are of major importance. Among the oils of which limited quantities are distilled in the United States are grapefruit, spearmint, erigeron, tansy, wormwood and wormseed, cedarwood, catnip, sassafras, sweetbirch, dillweed, hemlock, and mountain laurel. United States imports of essential oils during 1940 were estimated at $6,500,000.

In addition to the essential oils offered in their native state, certain of the oils are offered as "terpeneless" and "sesquiterpeneless." This indicates that the terpenes, which are usually low in odor value, have been removed. Similarly, certain oils are now also carefully fractionated to extract the actual flavor or odorous material, and are offered as two-fold, three-fold, and five-fold oils. Such oils in addition to being concen-

trated are frequently of better quality than the original material.

Since most essential oils are employed for their delicate odor or flavor, the final determination of their value falls on actual taste or fragrance. Two oils with identical chemical analyses may have different values placed on them commercially because of some slight difference in aroma or taste. The prices given in individual oil stories are those for average grades in the New York wholesale market.

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Ethereal Oils

See Essential Oils

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Ethyl Acetate

ETHYL ACETATE is a colorless liquid with a fruity, pleasant odor. It is also known as acetic ether, is slightly soluble with water, and is miscible with alcohol and ether. Commercially, ethyl acetate is marketed with ester contents of 85 to 88 per cent, 95 to 98 per cent, and 99 to 100 per cent. The first named is most common and is used in general manufacturing and as a solvent. The higher grades are employed in chemical synthesis processes and as special solvents. Impurities in the commercial grades are water, free alcohol, free acetic acid, and ether.

Federal regulations require that ethyl acetate sold for industrial use be denatured before leaving the manufacturer, to prevent its use in the illegal production of ethyl alcohol. The denaturant most often used is Calol ethatate, while methyl isobutyl ketone, methanol, and other compounds can also be used with permission of federal authorities. Production of ethyl acetate in 1940 amounted to 75,369,803 pounds; while sales totaled 60,632,757 pounds, valued at $3,571,439. In 1939 the total output in the United States was 67,897,408 pounds; with sales of 51,622,492 pounds, valued at $2,706,497. Ethyl acetate is shipped in single-unit tankcars containing 30,000 pounds; multiple-unit tankcars containing 6,000 or 8,000 pounds per compartment; in 55-gallon and 5-gallon steel drums; and in one-gallon cans.

Most important use of ethyl acetate is as a solvent in the manufacture of pyroxylin lacquers. Because of its solvent powers and chemical composition it also finds extensive use in the production of industrial products, including artificial fibers, inks, polishes, plastics, and explosives. The high grade product is also employed in the manufacture of pharmaceuticals, perfumes, and flavoring compositions.

The price of 85 per cent ethyl acetate on June 1, 1942 was from 11 to 12¢ per pound; while on January 1, 1942 it was from 7½ to 8½¢; and on the first of 1941 from 6½ to 7½¢ per pound. The 95 per cent material on June 1, 1942 was quoted at from 11¼ to 12¼¢ per pound; on January 1, 1942 from 8¾ to 9¾¢ per pound; and on January 1, 1941 from 6¾ to 7¾¢ per pound.

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Ethyl Alcohol

See Alcohol

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Ethyl Cellulose

See Plastics

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Eucalyptus Oil

EUCALYPTUS OIL is a colorless or pale yellow oil produced by steam distillation of the fresh leaves of various species of eucalyptus trees, particularly Eucalyptus globulus. The principal commercial source of the oil is Australia, while varying smaller quantities are produced in France, Italy, Spain,

Mexico, India and California. The California production is limited by the amount of eucalyptus growing in the area. The United States Pharmacopeial grade must contain 70% of eucalyptol, the chief ingredient.

The 1940 imports of eucalyptus oil amounted to 585,528 pouds, valued at $191,-133. Australia supplied 556,668 pounds of this total, and Spain 25,389 pounds. In 1939, some 522,527 pounds were imported, with a value of $135,205. In the latter year Australia furnished 517,966 pounds, and Spain 4,409 pounds. Commercially the oil is packed in 400-pound drums, 56-pound cases, and 50-pound tins.

The technical grade of eucalyptus oil is used as a flotation agent in the benefication of metallic ores. The purified grades are used in soap as a perfuming agent, and in various medicinal applications. On June 1, 1942 the price of eucalyptus oil was $1.00 per pound. Its price at the beginning of 1942 and 1941 respectively was 70¢ and 65¢ per pound.

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Europium

See Monazite

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Fenchone

See Turpentine and Rosin

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Feldspar

The term feldspar embraces a number of abundant minerals mined in the United States, closely related in crystalline form, and all aluminum silicates with either potassium, sodium, calcium or barium. They are vitreous in appearance and occur in crystalline masses or as crystals. The specific gravity ranges usually between 2.5 and 3.

They are glass making materials and United States production has risen to new heights recently with the increased use of glass containers.

Except for a relatively small production in the Scandinavian countries, most of the world's feldspars are mined in the United States. In 1940, domestic sales of crude feldspar totaled 290,763 long tons valued at $1,271,995 and 12,522 tons were imported from Canada. In addition, 285,713 short tons of ground feldspar valued at $3,065,482 were sold by United States mills. North Carolina was the principal producer of crude feldspar in 1940, followed by South Dakota, New Hampshire and Colorado. Connecticut and Virginia were also important sources. South Dakota and Colorado supplied about 35 per cent of the ground spar sold in 1940 while Tennessee and North Carolina mills accounted for a further 27 per cent.

Increasing interest has been paid recently by producers and consumers to rigid chemical control of batch ingredients. Definite standards were developed for alumina, lime and alkali content as well as stricter limits for iron. Feldspar meets competition from nepheline syenite, aplite, talc and pyrophyllite to mention a few materials entering the manufacture of whiteware bodies and other ceramic products.

Magnetic separators to insure a low-iron content and froth flotation for purification have been recent mill additions. Agglomerate tabling—a process which successfully treats much coarser sizes than can be handled by flotation—is also being used. Separation of both soda and potash feldspars from quartz is also effectively accomplished and electrostatis separation has been improved, too, to afford another means of removing impurities.

Feldspar is normally marketed in bags after being ground to from 20 to 80-mesh. The firing point of the various grades as well as the expansion factor varies. Tennessee and North Carolina spar vary from New England spar, while potash spar from New York

and New Jersey are still different. Soda spar is preferred for ceramic enamels. Carolina stone, from North Carolina, is a kaolinized feldspar similar to Cornwall stone imported from England. Aplite is a high-alumina ceramic flux produced in Virginia while nepheline syenite is valued for glass making and, aside from production in New York and New Hampshire, is imported from Canada free of duty up to 50,000 tons.

Most crude feldspar is sold to merchant mills which obtain material from a number of mines or localities. The mills store and sort it according to grade and source, blend and grind it to required purity and fineness, and sell the ground product. However, some pottery and enamel manufacurers purchase part of their requirements as crude and process it as needed with their own equipment. Several mine their own spar. Over 50 per cent of ground spar sold in 1940 went to the glass industry, not including nepheline syenite, aplite, or other sources of alumina. This was an 8 per cent increase over 1939. Sales to potteries increased by 20 per cent while sales to enamel manufacturers decreased slightly. Ground spar for use in soaps and abrasives, a minor sales outlet, increased sharply.

Feldspar quotations in mid-1942 were: enamel, 100 mesh, bulk, works $14.00-$17.50 per ton; glass, 20-mesh $9.75-$12.25; pottery $17.00-$19.00 bulk, Maine works; and the same for North Carolina. L. c. l., minimum two tons, prices were from $3.00 to $4.00 higher, generally.

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Fennel Oil

FENNEL, or fennelseed oil is pale yellow in color and obtained from the dried fruit of Foeniculum vulgare by distillation with steam. It varies according to source, the "sweet" oil having an anethole content of approximately 60% and a fenchone content of 10% to 15%, while the "bitter" oil has a higher anethole content and lower fenchone content. Fennel grows natively in the Mediterranean area and is cultivated in Germany, France, Russia, India and this country. Increased fennel cultivation in the United States is being encouraged as part of the chemurgic program.

All of the fennel oil imported in the United States in 1940, amounting to 6,547 pounds, with a value of $6,882, originated in Russia. In 1939 the total imports were only 265 pounds, valued at $212, all from Russia also. Commercially fennel oil is packed in 25-pound tins and in five-pound bottles and canisters.

Fennel finds its largest use in liqueurs and as a flavoring component in gin. It is also used in medicine, being official in the U.S.P., and in perfumery to a limited extent. On June 1, 1942, sweet fennel oil was quoted at $4.20 per pound. At the beginning of 1942, its price was $2.50; and at the same time in 1941 it was slightly over $2.00 per pound.

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Fennel Seed

FENNEL SEED is a light brown seed obtained from a cultivated perennial. It is produced mostly in India, Morocco, Persia, Roumania and Russia. Figures on world production are not available but the United States imports about 150,000 pounds annually. It is used in flavoring Scandinavian dishes, in preparing fish, pastry and in pickling, spices, curry, liqueurs, candy, etc. Marketing is in 50 and 60 kilos bags, with a price of from 10 to 12¢ per pound quoted in May of 1942. It will keep for about three years, if properly stored. Principal types, at present, are: Indian and Persian. Anise seed is rated as a substitute.

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Ferberite

See Tungsten

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Ferric Ammonium Citrate

See Iron Ammonium Citrate

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Ferrocolumbium

See Columbium

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Ferro Manganese

FERRO MANGANESE is an alloy of manganese and iron, usually in lump form. It is produced by smelting manganese ore in blast furnaces or electric furnaces. Estimated production in the United States during 1941 was 550,000 gross tons. Ninety percent of the manganese ore used to produce ferro manganese is ordinarily imported from India, Africa, Russia and South America but the war disruption of shipping has brought a much stimulated production in the United States, increased by efforts of the U. S. government. Cuba is growing steadily more important as a source of U. S. supply for the ore. Its principal use is in the melting of steel, as a deoxidizer and alloying element. Ferro manganese is marketed by the gross ton of 2,240 pounds, usually in carload lots. The May 1, 1942 price was $135.00 per gross ton f.o.b. base shipping point. It is usually transported by rail, in bulk. The standard type is 78/82% Ferro Manganese. There are practically no substitutes. The United States import duty is 1¢ per pound of metallic manganese content. (See Manganese.)

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Ferrosilicon

FERROSILICON is a high-silicon iron employed for the purpose of manufacturing silicon steels. It is used also in the electrolytic reduction of copper and for adding silicon to cast irons.

Shipments of ferrosilicon in 1940 increased by 25 per cent over 1939. The production in 1940 totaled 409,699 tons, including 190,310 tons made by blast furnaces, 219,141 tons by electric furnaces, and 248 tons as a by-product in the manufacture of artificial abrasives in electric furnaces. The silicon content of the production in 1940 ranged from 7 to 95 per cent with an average of 28 per cent. Most of the raw material used in making ferrosilicon was of domestic origin.

In July 1942, the "American Metal Market" quoted Bessemer ferrosilicon, f.o.b. Jackson Ohio furnace at $38.50 per gross ton for the grade containing 10.00 to 10.50% Si. For each additional .50% silicon up to and including 14.00%, add $1.00 per ton. Also add 50¢ for each .50% of manganese over 1%. Base prices at Buffalo, $1.25 per ton higher than at Jackson.

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Ferrotitanium

See Titanium

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Ferrovanadium

See Vanadium

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Fertilizers

As a result of war needs, many changes and many new influences greatly affected the normal operations of obtaining and furnishing plant-food to crops. It became necessary for this country to grow additional quantities of

certain food and fibre crops in order to supply our own armed forces and to fulfill our obligations to our allies under the lend-lease program.

Greatly increased crop goals were established by the U. S. Department of Agriculture to meet these needs, necessitating the most intelligent use of all the obtainable plant-food.

It has been truly said that "crops and cannon eat the same food." Nitrogen, one of the most important of the plant foods, is also a necessary ingredient of all modern explosives. At the outbreak of the war this country was producing considerably more than enough nitrogen to supply all peace requirements. Additional producing plants were under construction then and more have been started since. Scarcity of ship's bottoms and sinkings caused a temporary shortage in imports of nitrate of soda, an important raw material for fertilizer use and for explosive manufacture. However, more sulphate of ammonia will be produced than ever before as well as more organic by-products furnishing nitrogen, such as cottonseed meal, peanut meal and soybean meal. It is possible that there may not be quite as much chemical nitrogen as will be wanted for growing crops in 1943. As new nitrogent plants come into production and as additional ships become available, any such shortage will be overcome. In any event it appears that most of the nitrogen needed for agriculture will be available and any shortage that does occur will not be serious and will soon be relieved. All chemical nitrogen is under allocation by the War Production Board. The U. S. Department of Agriculture recommends to the War Production Board what amounts of chemical nitrogen should be used on each crop in each area and chemical nitrogen is distributed to fertilizer manufacturers in accordance with these recommendations. Production of both super-phosphate and potash salts has greatly increased during the past year and is still increasing. There should be sufficient phosphoric acid and potash to meet all fertilizer needs.

Fertilizers in the past have been packaged largely in burlap bags, some cotton and paper bags being used. The war in the Pacific has greatly curtailed the importation of burlap, and cotton has been in great demand for direct war use. The use of paper bags for fertilizer has proportionately increased until they are greatly preponderant at present. Manufacturing plants have installed sewing machines and other necessary equipment to enable them to economically handle the filling and closing of paper bags.

Transportation is an item of major importance in the war time fertilizer program. Formerly much of the tonnage of raw materials was moved by water in coastwise and intercoastal vessels. These boats have been diverted to other war needs and practically all inbound shipments are now all rail. Shortage of tires and gasoline rationing have increased outbound shipments by rail at the expense of truck movements. The railroads have done and are continuing to do a splendid job in the face of their greatly increased operations.

The sale and distribution of fertilizers and fertilizer materials are governed in the main by three maximum price orders of the Office of Price Administration. Maximum Price Regulation 108 fixes the maximum resale differentials that can be added to the original purchase prices of nitrate of soda, sulphate of ammonia and cyanamid. Maximum Price Regulation No. 135 fixes ceiling prices for mixed fertilizers, superphosphate and potash. The General Maximum Price Regulation establishes ceiling prices for transactions not otherwise provided for in the other two. The general effect is to fix ceiling prices at the price level existing during the early part of 1942.

In normal times the raw materials for the manufacture of commercial fertilizers came

from many sources. Prior to the first World War, practically all potash for agricultural and industrial purposes was imported from Germany and all nitrate of soda from Chile. Norway furnished calcium nitrate and Germany urea and calcined kieserite. Sulphate of ammonia was imported from Holland and Belgium, and by-product organic tankages from England, the Continent, and South America. Faced with the impossibility of obtaining some of these necessary materials from customary sources because of the World War blockades and scarcity of ships' bottoms, public and private agencies set out to make the United States independent as to its plantfood requirements. Their efforts have been successful. Within our own borders we can produce all of the plantfood that is needed for crop production. However, the commandering of nitrogen for explosives may cause temporary shortages. Likewise, manufacturing facilities are presently available with sufficient capacity to compound these materials into mixtures appropriate for each and every soil and crop.

Fertilizers are mainly valued because of their plantfood content of nitrogen, available phosphoric acid, and available potash. Fertilizer materials are substances furnishing one or more of these plantfoods or some other recognized plantfood elements.

The largest source of fertilizer nitrogen is sulphate of ammonia, a by-product of coke and gas manufacture which is produced in some 90 coke plants and a number of gas plants located over the country, the coke plants being largely in coal-producing areas. Production of sulphate of ammonia in 1940 increased 23 per cent over 1939, reaching a total of 717,191 tons. Ammonia is also synthetically produced by the fixation of atmospheric nitrogen in 9 plants in this country, the two largest of which are located at Hopewell, Virginia, and Belle, West Virginia. Nitrate of soda and nitrate of ammonia are also produced at the Hopewell plant and urea at the Belle plant. Some 250,000 tons of nitrogen were synthetically manufactured into compounds in the year ended June 30, 1940. Additional nitrogen fixation plants have been or are being constructed under the War Program. In addition to the inorganic forms of nitrogen mentioned above, there are many thousands of tons of organic by-products of the food industry that are used in fertilizer manufacture—tankage, dried blood, and ground bone from the packing houses; fish scrap and fish meal from the canneries; cottonseed meal, peanut meal, castor bean pomace, and soybean meal from the vegetable oil mills. Other inert nitrogen-carrying organic by-products such as leather scrap, feathers, hair, and wool waste are subjected to processing so as to convert the nitrogen contained in them into an available plantfood suitable for fertilizer manufacture. The fertilizer industry uses annually over 2,300,000 tons of nitrogen-bearing materials containing in total some 400,000 tons of nitrogen.

Most of the phosphoric acid used in fertilizers is in the form of superphosphate. This material is produced by mixing together substantially equal portions of fine ground phosphate rock and sulphuric acid. A chemical reaction takes place which converts the insoluble phosphates of the rock into a form available to plants as food. The necessary sulphuric acid is manufactured by burning sulphur or iron pyrites and absorbing the resulting fumes in water, or by absorbing the sulphur fumes of zinc and copper smelters. Sulphur is produced in large quantities in Texas, and pyrites are imported from Spain, Cuba, and other countries. The phosphate rock used in the manufacture of superphosphate is found in enormous high-grade deposits in the States of Florida, Tennessee, Idaho, Utah, Wyoming, and Montana. Lower grade reserves are also found in South Carolina, Kentucky, Arkansas, and other States. Because of advantageous geographical loca-

tion adjacent to fertilizer-consuming territories, most of the rock now being used is mined in Florida and Tennessee. Our annual consumption of rock is approximately 2,500,000 tons. Government geologists estimate that there are between 2,000,000,000 and 3,000,000,000 tons of high-grade rock in Florida, 200,000,000 tons in Tennessee, and over 7,000,000,000 tons in the western States—enough at the present rate of consumption to last at least 3,000 years. Our normal annual production of superphosphate has been between four and five million tons a year, but the capacity of existing plants is at least double that amount. Production was the largest in history during the past year and is still increasing. Normal superphosphate as manufactured contains around 19 per cent of available phosphoric acid. A concentrated superphosphate containing 45 to 48 per cent available phosphoric acid is also produced by acidulating phosphate rock with phosphoric acid produced either by first treating phosphate rock with sulphuric acid or by furnace methods.

High-grade muriate of potash has been continuously produced from the brines of Searles Lake, California, since 1916. Three large operations are also producing potash salts from crystalline deposits underground near Carlsbad, New Mexico. One of these started production late in 1940.

In 1939, domestic production amounted to 524,986 tons of potash salts. High-grade muriate and sulphate of potash and the lower grade product commercially designated as manure salts are being produced here in larger quantities now than in 1939. A survey of the domestic potash industry by the U. S. Bureau of Mines states that no potash shortage now threatens this country and that our present producers can supply all the potash required to meet essential needs.

Imports of fertilizer materials in former years consisted largely of potash salts and nitrogen-bearing materials from Europe, nitrate of soda from Chile, and cyanamide from Canada. War in Europe and resulting blockades and ship shortages have stopped practically all shipments from Europe at the present time, but we continue to import large tonnages of nitrate of soda from Chile. During the calendar year 1940 we imported 664,000 tons of nitrate of soda, 118,000 tons of cyanamide, and 185,000 tons of various other nitrogen carriers. Potash salts to the extent of 245,000 tons were imported early in 1940 before the present blockade Some 83,000 tons of bones and other phosphate carriers and 38,000 tons of miscellaneous fertilizer materials were also imported, making a total import tonnage of 1,334,000 tons. We will probably continue to import nitrate of soda from Chile and cyanamide from Canada, but otherwise domestic production will be substituted for products formerly imported.

Fertilizers and fertilizer materials are all duty-free. No particular regulations govern their import except in the case of animal and vegetable by-products which are subject to certain requirements of certification or disinfection to prevent possible introduction of disease. By far the greater part of fertilizer material is imported in bulk cargoes, the balance usually in burlap bags of 100 pounds or 200 pounds weight, occasionally in metric or odd-weight bags.

Ultimate consumption of fertilizers and fertilizer materials is highly seasonal coincident with the planting season, but raw materials are produced and imported throughout the year and stored in anticipation of consumer demand.

Although it is known that at least fourteen chemical elements are necessary to support plant life, all but three of them are likely to be found in good agricultural soils in sufficient amounts to grow normal crops. these three—nitrogen, phosphorus and potassium—are usually designated as the primary plantfood elements and are the ones normally

used to evaluate a fertilizer. In ordinary fertilizer practice, nitrogen is spoken of in the elemental form (N), phosphorus is spoken of as phosphoric acid (P_2O_5), and potassium as the oxide, potash (K_2O). The grade of a fertilizer is designated by numerals separated by dashes, the numerals representing the percentage content of nitrogen, phosphoric acid, and potash in that order. For example, a 4-12-4 grade of fertilizer means that the mixture contains 4 per cent of nitrogen, 12 per cent of phosphoric acid, and 4 per cent of potash.

Grades of fertilizers are selected according to the needs of each crop when grown on a particular soil. Plantfood requirements of the various crops often differ materially. Likewise, soil types vary widely in their content of nitrogen, phosphoric acid, potash, and other plantfoods that are available for plant consumption. There is some grade however —some ratio of nitrogen, phosphoric acid, and potash content—that is particularly suitable for each crop and soil combination. Years of experimental research by State and Government agricultural experiment stations and by technologists of the fertilizer industry have developed data which determine within rather narrow limits the grade of fertilizer most likely to produce satisfactory results from its use on a certain crop when grown on a particular soil type.

Generally speaking, the higher the total plantfood content of a fertilizer, the more economical to the farmer will be its use. Manufacturing, bags, and freight costs are all measured in terms of a ton. These items cost just the same for a ton of 4-12-4 grade of fertilizer with a total content of 20 per cent of plantfood as they do for a ton of an 8-24-8 grade with a total content of 40 per cent plantfood, but the cost for each unit of plantfood is much reduced in the higher grade. It is usually conceded that the use of grades of fertilizer carrying less than 16 percent of total plantfood is uneconomic and that grades carrying the higher total plantfood contents are progressively more economical. A limit to this principle is reached, however, when the grade gets so high that more expensive, higher grade raw materials must be used to obtain the necessary plantfood.

In the interest of the national economy and the war requirements, the War Production Board is expected to issue orders designating the specific grades of mixed fertilizer that may be sold in each state, specifying also the crops on which they may be used.

In most sections of the United States fertilizers are sold by the producer-manufacturer to the farmer-consumer through agents. Prices are quoted on a delivered-to-the-farm basis. Many of the agents are firms in small towns carrying on other enterprises related to or serving agriculture, such as implement dealers, grain elevators, and hardware stores. In smaller communities, cross-road country merchants often are agents for fertilizer manufacturers. In many if not most cases they are not exclusive agents for any one manufacturers but are joint agents for several. It is customary for an agent to carry small stocks of the most popular fertilizer grades, in order to accommodate small buyers. These stocks are received in carload or truckload lots. When a farmer comes to an agent's place of business and hauls his fertilizer away he is generally given a reduction in price to compensate him for this farm-delivery service. If a customer goes to a fertilizer factory and hauls his purchase of fertilizer away he is usually made an allowance for this transportation equal to the carload rail freight to his nearest shipping point or the allowance is made on a ton-mile basis for the highway distance involved. When a customer orders a carload of fertilizer it is usually shipped direct to the purchaser's nearest railroad siding. Quotations are frequently made on cash basis and credit basis. Payment for goods sold on credit is required

at some specific time in the future, generally at harvest time. Discounts are allowed for prepayment and interest charged on overdue accounts.

The local representatives of fertilizer manufacturers—either agents or dealers—are usually able to make general recommendations to a buyer as to what grade of fertilizer is best adapted to his purpose. Competition is keen. When like grades produced by several different manufacturers are offered for sale by the same joint agent, each guaranteed to contain the same amount of plantfood, there is little opportunity for any variation in the sales price of each. If there were significant differences in price, the lower priced brand would take all the business and the higher priced would remain unsold. In addition to the local agents, many manufacturers have field representatives who visit the farmers of their territories, advise them on their particular requirements, and also visit and advise the agents in their territories in the general interests of sale promotion for their companies.

The purchaser of fertilizer is protected as to the quality of the goods he buys even more fully than the purchaser of human food is protected in his purchases. Forty-seven of the forty-eight States (Nevada has no fertilizer law) have enacted and are diligently enforcing fertilizer control laws for the protection of their farmer fertilizer consumers and the protection of legitimate fertilizer manufacturers. Under these laws, the amount and quality of the plantfood content of any fertilizer offered for sale must be guaranteed and a plainly printed statement of such guarantee must be either on every bag or package or on a tag attached thereto. Samples of all brands offered for sale are taken by official inspectors and analyzed by the State chemist. Severe penalties are provided and enforced for any failure to meet the guarantee. Under such rigid requirements it is customary for manufacturers to allow some overrun in plantfood content to insure that the official analysis will report their goods to be up to guarantee. For example, the control officials of North Carolina, our heaviest fertilizer-consuming State, reported that in 1939 the average overrun in plantfood as shown by the analyses of samples reported by the State chemist was valued at 81 cents a ton of fertilizer on a consumption of 1,215,-890 tons of fertilizer, so that, based on these figures, the farmers of North Carolina received $984,870.90 worth of fertilizer more than was guaranteed to them when they made their purchases.

Consumption of fertilizer is greater in our older agricultural areas. In general, the heavy consuming area lies along our Atlantic and Gulf seaboards, gradually spreading westward to and slightly beyond the Mississippi River. Another area lies along the Pacific Coast. The six southeastern States of Virginia, North Carolina, South Carolina, Georgia, Alabama, and Mississippi consume about 60 percent of all our fertilizer tonnage.

It can be truly said that the fertilizer marketplace is the crossroad store. There are estimated to be some 50,000 agents of fertilizer companies and retail fertilizer dealers throughout the country. These are furnished their fertilizers by nearly a thousand fertilizer factories strategically located so as to provide not only minimum transportation costs on the finished material but to expedite delivery in the height of the planting season. Not so long ago practically all fertilizers were shipped by rail to local destinations and there delivered to the consumers' wagons for transportation to the farm. The advent of the motor truck and the improvement of our highways have brought about a considerable change in the method of fertilizer transportation. While rail transportation still predominates in certain sections of the country, probably better than 60 percent of fertilizer today is moved from factory to farm by truck.

Although many thousands of tons of fertilizer materials are used as such direct in agriculture for specific and special purposes, the finished product of the fertilizer industry is the many grades of mixed fertilizer, sometimes containing only two but most generally all three of the primary plantfoods—nitrogen, phosphoric acid, and potash.

American practice preponderantly demands economy in labor to the extent that planting and complete fertilization be accomplished mechanically with one expenditure of labor. Grades are manufactured to meet all usual crop and soil conditions. However, special formulation of a particular grade may be necessary to meet a special crop or soil condition. In the sandy soils of the coastal plain it is often considered desirable to have a proportion of the nitrogen content of a fertilizer derived from some organic source that is not immediately soluble in water and so will not leach out in the first heavy rain. As the material decomposes in the soil its nitrogen becomes available to plants as food. Again, some crop grown for a special purpose, like some of the types of tobacco grown for cigar manufacture, may require special formulation. If tobacco is grown with fertilizers using chloride of potash as its source of potash, the plant may be healthy and vigorous and produce excellent yield, but the ash of its leaves has so low a melting point that a cigar made from these leaves will not smoke satisfactorily, as the ash will tend to fuse and the cigar will not draw. For cigar tobacco it is necessary to use mainly sulphate of potash in the fertilizer so as to keep the chlorine content of the ash within the necessary limits to prevent fusion.

Mixed fertilizers are produced primarily for domestic consumption. Exports are of little importance and go mostly to Canada, Cuba, and Central America. In addition, shipments are made from the mainland to Hawaii, Puerto Rico, and the Philippines.

Consumption of the finished fertilizers is highly seasonal. The farmer buys his fertilizer when he is ready to plant his crop and demands delivery at once. The chemical nature of the product is such that it does not lend itself to long storage in packages. Chemical reactions within the mixture are likely to take place which may either cause it to set up like cement so it can not be properly distributed by machines or cause corrosive gases to be released which will destroy the fibers of the bags. It is estimated that fully 70 per cent of the fertilizer sold is shipped in a ten weeks' period fluctuating between February 15 and May 15, according to the season's variation. A lesser peak period occurs in the fall.

Farm income is the main factor in determining the consumption of fertilizers. The two curves closely parallel each other, the consumption curve lagging slightly. Farm income in 1929 was $12,049,000,000 and consumption of fertilizer that year amounted to 8,010,957 tons. At the nadir of the depression, 1932, when farm income dropped to $5,284,000,000, fertilizer consumption fell to 4,384,018 tons. Both rose gradually through the years until the farm income of 1937 reached $10,003,000,000 and fertilizer consumption 8,194,699 tons.

As briefly discussed previously, distribution of fertilizers is either direct from producer to ultimate consumer or by the producer's local agents to the consumer. Compensation for these agents is usually based on a percentage of the purchase price, generally ranging from 5 to 10 percent depending on the services rendered by the agent and whether he guarantees the payments for goods sold on a credit basis. There are no wholesale dealers and no jobbers.

The trade association activities of the fertilizer industry are carried on in numerous small organizations purely local in membership and interests and in one country-wide organization, The National Fertilizer Associa-

tion. The activities of this trade association are largely educational. Its efforts are mainly to the end that the best agronomic information, as determined by State and Government agricultural experiment stations and by private research within the industry, is brought to the immediate attention of all agricultural workers and those interested in agriculture. Among the various agencies used in the dissemination of agronomic information is a periodical, THE FERTILIZER REVIEW, devoted to agricultural and agronomic articles which is sent gratis to over 20,000 county agents, vocational teachers, and other agricultural workers. Hundreds of thousands of bulletins and pamphlets on special crops and different phases of modern agriculture are distributed yearly. Colored motion pictures, one on pasture improvement, one on proper methods for the application of fertilizer and one on the value of organic matter in the soil are being circulated in many copies over the country in this educational program. A book has recently been published in cooperation with The American Society of Agronomy, entitled "Hunger Signs in Crops," written by outstanding agronomic authorities of the country and illustrated with 80 colored plates describing and showing the symptoms which develop in the various crops when each of the plantfoods is deficient in the ration available to the crop. The Association staff frequently visit the agricultural experiment stations of the different States and cooperate with them in every possible way in their endeavors to determine and distribute the facts of agriculture.

The Association also collects and disseminates to the public and to its members statistical information regarding fertilizers and other agricultural topics of interest to them.

The industry, through The National Fertilizer Association, by official action at its annual conventions has pledged whole-hearted support to the War effort and is contributing in every possible way in cooperation with governmental agencies to the achievement of war production crop goals.

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Figs

FIGS are an oblong or nearly globose tree fruit, pulpy when ripe, and eaten raw or preserved or dried with sugar. They are grown commercially largely in the Adriatic and Mediterranean areas, and in the United States are produced principally in California, Arizona, and Texas.

Marketed commercially largely in dried form (with a limited quantity canned or bottled), figs are used principally in the manufacture of crackers, cakes, and candies, as fillings. In packaged form, a part of the annual production is marketed for direct consumer use.

Before the war halted imports, the American market was supplied largely from Greece, Italy, Spain, Portugal and Turkey, particularly on the higher grades. No imports have been made since 1940, when 700 tons came in.

The principal commercial grades in imported figs are string figs, and layer packaged figs. Domestic grades are White Adriatic, Calymyrna, and Black Mission figs, in the dried varieties, and Kadotas, in the preserved canned or bottled field.

Domestic production rose from 19,000 tons in 1932 to 32,800 tons in 1941, consisting of 12,000 tons of Adriatics, 9,000 tons of Calymyrnas, 8,400 tons of Black Missions, and 3,400 tons of Kadotas in the latter year.

The unit of purchase from the grower is the pound. String figs, which are now packed in California to replace the Greek product, are packed 30 one-pound cellophane packages to the case. Dried figs are packed in 25 and 60 pound wooden boxes. The canned or bottled Kadotas are sold per dozen, packed in wooden or corrugated cases, two dozen to

the case, at prices varying widely according to the prominence of the packers' brand.

No quotations on imported figs are available. As of July, 1942, the domestic product, string figs was quoted at 18 cents per pound. White Adriatics ranged from 13½ to 18 cents, as to grade; Calimyrnas 16½ to 22 cents; Black Missions 6½ to 11 cents. Figs packed in layers command top prices; "bricked" figs are the lower grades.

Domestic figs are now shipped to consuming markets all-rail, although normally a large part of the crop moves Eastward from the Pacific Coast via the intercoastal steamship lines.

Figs are perishable and must be held in cold-storage except in the winter months, when ordinary "cold" warehousing will suffice. They must be handled carefully to protect against insect infestation and deterioration of marketability.

Substitutes used commercially for fig paste are unavailable, although date filling is used at times when the fig paste is in short supply.

Rates of duty are 5 cents per pound on figs valued under 7 cents per pound and 3 cents per pound on figs valued at more than 7 cents. This seeming inconsistency is accounted for by the fact that the duty was set up to protect domestic producers of low grade figs.

Figs come under the provisions of the General Maximum Price Regulation.

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Filberts

FILBERTS are an edible nut having a hard, brownish color shell. There are two main types, the round or Barcelona type and the long or DuChilly type. The nuts occur in clusters of from 2 to 12 nuts, with 4 to 5 the average. They are a comparatively new industry in the United States with tonnage and acreage increasing yearly. Total U. S. production, which approximates 5,000 tons, is almost exclusively in Washington and Oregon, with the latter state leading. Average annual foreign production, concentrated in Turkey, Spain and Italy, is 107,000 tons. They are sold mostly as mixed nuts in the holiday season but an increasing amount is being shelled for sale as salted nuts for use in candies or baked products. Filberts are normally marketed in 100-pound bags. The price, dependent to a large extent on imports, ranged from 16¾¢ to 21¢ per pound for the 1941 crop, or about 2¢ higher than in 1940. Due to their low moisture content, the nuts will keep almost indefinitely in the shell, but should be kept in cool storage during the summer months to prevent excessive drying. Filberts are graded to size as Jumbo, Large, Fancy, and Baby. Differentials between grades are fairly constant. The present United States import duty is 5¢ per pound on nuts in the shell and 8¢ per pound on shelled. The war sharply curtailed imports from Europe.

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Fine Chemicals

EXACTLY when a chemical material can be considered as "fine," and when it may be considered a "heavy" or "industrial" chemical is difficult to specify. Generally, the fine chemicals are the medicinal materials and more refined chemicals which require added care in production, shipment, and storage. With the growth of the chemical industry, some of the materials still today classed as fine chemicals are produced and consumed in enormous quantities, and in many cases have become more important as industrial raw materials and to everyday life than some readily classifiable as heavy chemicals. In the individual articles are outlined the properties and commercial data concerning some of the well known fine

chemicals. The prices given are approximately those for commercial quantities in the New York market.

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Fique Fiber

COLOMBIA'S contribution to the shortage of Manila hemp (abaca) is fique. The fiber has been used in Colombia for making heavy sacks for the coffee export trade, for "pergamino" or unprepared coffee, and in the salt trade. It is estimated that 10,000,000 sacks are produced annually consuming about 15,000,000 pounds of fiber. Of this production, about 1,000,000 bags are factory-made. Probably four times this output of sacks could be sold abroad if machinery and fiber were available. The fiber also serves all purposes for which jute, manila, sisal and henequen are used in the United States, and the Colombian Government is encouraging its production.

The output in 1941 was 38,428,500 pounds against 20,709,106 pounds in 1932, with the greatest spurt coinciding with the war. The price in June, 1942 was about 6½¢ per pound f.o.b. Colombian ports.

Nearly 40 million plants grow wild, often in inaccessable places and about one-third are exploited by small farmers but 90 per cent of the 4,350,000 "fiquales" which are cultivated on plantations find their way into domestic fiber production. It takes four years before the fiber growth becomes profitable; the life span of the plant is long—up to 23 years.

Approximately 2¾ pounds of fiber can be extracted from each "figuale," and as little more than 2 per cent of each leaf is fibrous a great many leaves and much hauling are needed to produce yarn for sack-making. Defibrinating the leaves is a difficult, manual operation which requires much strength and the juice of the leaf is highly acid and injures workers' hands so much that labor is possible only every second day. Only about 10 per cent of the production is by mechanical defibrination. Proper decorticating machines would increase the output and eliminate present waste.

It has been suggested that the juice of the fique leaf could be extracted and the pressed mass shipped to the United States for defibrination and processing. The juice could be utilized as a degumming agent by textile mills, it is said. There are other claims that the juice can be used as an adhesive agent in the manufacture of glue, and also that it can be distilled into alcohol.

Under present methods of manufacture, the texture of fique fibers is somewhat harsh, but, when separated into its smallest threads, it becomes very soft and fine. Further research may develop a process to soften the fiber without injuring its strength. This would improve the quality and broaden the uses for fique.

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Fir

See Douglas Fir

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Fire Clay

See China Clay

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Fish

THE commercial fisheries of the United States and Alaska constitute one of the most important of our natural resources. The 1940 production was 4,056,524,000 pounds of fish, shellfish and by-products, with a value of $98,635,000, divided as follows:

Fish amounted to 3,609,001,000 pounds with a value of $71,923,000. These figures include menhaden, which are primarily a by-product fish, and pilchard, also in the by-product field.

Shellfish amounted to 446,723,000 pounds with a value of $26,683,000. In these figures are also included sea weed, sponges, bloodworms and sandworms, etc. of the non-food type but highly important commodities of trade.

Whale products totaled 800,000 pounds valued at $29,000. The whaling industry does not have the importance or productive values of years ago but is still considered as part of the commercial fisheries.

There are 162 edible varieties of fish and shellfish used in the United States. The per capita consumption is, roughly, 14 pounds. Per capita consumption of seafoods by the Army is estimated at 20 pounds.

The figures quoted above and other figures on production and value were compiled by the Fish and Wildlife Service, Department of the Interior.

Although 1940 production was lower in volume than in 1939, the values show a decided increase. The total catch for 1939 amounted to 4,443,328,000 pounds with a value of $96,532,000. For fish alone, the total was 3,979,400,000 pounds with a value of $70,937,000. Shellfish amounted to 458,-765,000 pounds with a value of $25,421,000. Whale products amounted to 5,159,000 pounds with a value of $174,000.

It is also interesting to note that 1939 figures show a gain in both production and values on all seafood products over the year of 1938, indicative of the trend, which was decidedly upward to the year of 1939.

Although figures are not now available it can safely be assured that production for 1942 will show a very substantial drop while value will probably increase. The 1942 level of seafood prices equal and in some cases surpass the high level market prices of 1929, the year when seafood prices reached their highest point.

Not only have the commercial fisheries contributed tremendously to the food program of the United States and our Allies in this war, through millions of pounds assigned to our armed forces and through the Lend-Lease program to our Allies, but also in providing vessels for our navy and men to man them.

Although actual figures cannot be supplied at this time, hundreds of fishing vessels on all coasts have been taken over for navy use as mine layers, mine sweepers, scout boats and patrol boats. Thousands of fishermen have volunteered for the navy and coast guard.

The loss of fishing vessels and of men have contributed greatly to the drop in production while the increasing demands by our armed forces, lend-lease and our own consuming public, have created a tremendous market that explains the rising prices.

Of the various producing areas, including all types of seafoods, the 1940 statistics show that the Pacific area leads with 1,453,281,000 pounds valued at $29,256,000. Considerably below in volume but very close in actual value were the New England fisheries with 625,054,000 pounds, valued at $20,494,000. The South Atlantic and the Gulf produced 575,533,000 pounds, valued at $14,645,000. Alaska produced 563,688,000 pounds valued at $10,612,000. The Middle Atlantic area produced 355,553,000 valued at $7,651,000. The Chesapeake area contributed 320,736,-000 pounds valued at $7,457,000. The Great Lakes followed with 79,296,000 pounds valued at $5,623,000, and the Mississippi River and its tributaries produced 82,383,000 pounds valued at $2,897,000.

Of tremendous growth, within the past year, have been the shark and liver fisheries. Shark livers are high in vitamin A content—a vitamin highly essential to our war effort. As a result of this demand, shark are being sought by fishermen on both coasts, as well as the livers of dogfish (classed as useless previously) and livers of other types of fish.

Shark, in addition to their livers, have a value for their hides (they make excellent leather), the fins, the teeth and the carcass,

which goes into fish meals. Shark liver oil production for 1940 amounted to 223,252 gallons valued at $1,124,950. All types of fish oils amounted to 19,022,917 gallons vallued at $7,713,238.

Fishermen on off-shore vessels, inshore and on land, numbered 131,325 during 1939. There were 5,413 vessels (steam, motor and sail) amounting to 112,905 net tons. In the smaller boat class, motor and accessory, there were 70,717. Fishermen used over 297,754 nets that include seines, trawl nets, gill nets, pound nets, fyke nets, etc.

A new development of comparatively recent years, has been filleting of fish. A fillet usually consists of the side of fish, free of bones. This development naturally lead to the packaging of fish and today's packaged fillets, both fresh and frozen, are the pride of the industry.

The trend in this packaged fillet trade has been toward the frozen package. Quick freezing first developed with fish, and fish today are one of the main items that are quick frozen extensively.

Packaged fish are packed in several different ways. They are wrapped in plain, unprinted vegetable parchment wrappers; in printed colorful, vegetable parchment wrappers, and in cellophane, both plain and color printed. From one to two fillets are wrapped together—the average weight being about one pound. The same applies to the steaks, sticks and pan-dressed fish. The wrapped fish are then packed in cartons (there are a number of different types of cartons) and also in wooden boxes. Sizes of these carton and wood containers are 5-10-15-20-25 pounds. The cartons themselves are packed for shipping in corrugated shipping containers, sizes of the orders often determine the size of the shipping boxes. Fresh packaged fillets, steaks and pan-dressed fish are packed in 10-15-20-25-30 pound boxes.

Also important are the canned seafood products. During 1940 383 canneries packed 18,899,029 standard cases, amounting to 708,477,634 pounds with a value of $94,114,046. This was a drop from 1939 when 400 plants packed 19,427,982 standard cases of 716,812,141 pounds valued at $96,-458,593. A standard case is equal to 48-1 lb. cans (pilchard); 100-$\frac{1}{4}$ lb. cans (sardine herring); 48-5 ounce cans (oysters, shrimp) and, in general, 48 to 100 cans per case.

The year of 1942 will probably show a very drastic drop. Lack of tin containers for many of the seafood items, plus inability of our West Coast fisheries to operate at full capacity, due to lack of ships and the war zones, covering some of the choicest fishing areas, will drastically curtail the packs.

Total values of by-products for 1940 amounted to $17,145,770, compared with the 1939 a total of $20,950,862. These included fish meals, oils and scrap.

The volume of fish moved by trucks has grown tremendously over the past few years. Great quantities also move by express shipments and refrigerator cars. Additional quantities are also moved by vessels along coastwise routes.

Refrigerator cases, used in shipments to individual firms, have made their appearance. Usually, they are large metal encased, insulated boxes that can be refrigerated by dry ice or water ice. They are capable of holding fish fresh, without further refrigerants added, over long distances.

In addition to the various shipping containers already mentioned we might add that most fish, gutted or dressed (not packaged) are shipped in (Fresh water fish) 50 and 100 pound wooden boxes; (Salt water fish) 100, 125, 150, 200 pound boxes and 250 pound sugar or flour barrels as well as 75 and 150 pound tight barrels. Some small fresh fish are shipped in 10, 20 and 30 pound containers. In the frozen fish most of the whole, gutted or dressed fish are shipped in 50, 100, 150 and 200 pound boxes, small fish are

shipped in 5, 10, 15, 20 and 25 pound boxes and containers.

In the shellfish field oysters and clams (shucked) are shipped in gallon, ½ gallon, quart and pint containers (tin and fibre); crab and shrimp meat (cooked) come in one and five pound tins; shrimp, fresh, in 100-125 pound boxes and frozen in five and ten pound cartons. Shell oysters and clams are shipped in bushel baskets, burlap bags and wooden barrels.

There is no price ceiling on fresh fish and shellfish, including crabmeat. There is a price ceiling on frozen fish and shellfish, in line with the general price ceiling regulation on other commodities. This ceiling was expected to curtail the production of the frozen items.

The industry is considered a war industry, and, as such, receives favorable priority ratings. As high as A-1-j has been accorded in practically all types of vessel equipment, and as high as A-1-a on others. Harold L. Ickes, Secretary of the Interior, has been named as Fishery Coordinator by President Roosevelt.

Previous to the war many thousands of pounds of fish and seafood products were imported from practically every sea fronting country in the world; imports exceeded the exports by thousands of pounds. Today the picture has changed. Exports through lend-lease, are high; imports are practically nil, except for Canada, South America and in a minor degree, South Africa (lobster tails).

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Fish Liver Oils

THE most important of the fish liver oils is cod liver oil. The material is obtained from the livers of the codfish, Gadus Morrhua, by rendering with steam, separating the oil, then chilling the oil to solidify the stearin. Commercial grades of the oil vary from dark brown to a pale yellow in color. The dark oils are employed in industrial operations, such as leather dressing and chamois tanning, and the pale oils consumed for their rich vitamin A and D content. Intermediate oils are also used as a source of vitamin concentrates, and the devitaminized oils then employed commercially.

The United States Pharmacopeia requires that codliver oil contain at least 600 U.S.P. units of vitamin A and at least 85 units of vitamin D per gram. A nondestearinated codliver oil is also official in the U.S.P., having the same vitamin content, and consisting of the entire fixed oil and containing not more than ½ percent, by volume, of water and liver tissues. The U.S.P. permits the addition of specified flavoring substances if desired.

Another rich source of vitamin A and D is halibut liver oil. Its vitamin A content particularly is several times that of cod liver oil. The medicinal oil is sold on the basis of its vitamin A content, expressed in thousand units per gallon. Above standard oil is usually diluted to the desired concentration by the addition of a bland vegetable oil, such as cottonseed.

In recent years other fish liver oils have also come into prominence as vitamin sources. Shark liver oil, particularly that of the soupfin shark, dogfish liver oil, tuna liver oil, and swordfish liver oil production has reached a substantial volume, especially on the Western coast. Refined oils from these sources are processed to secure vitamin concentrates; the crude and devitaminized oils going into the leather industry and into paint and soap manufacture.

Imports of codliver oil into the United States during 1940 amounted to 2,114,392 gallons, valued at $2,521,239. The principal countries from which the oil originated were Iceland and Newfoundland. Previous to the war, the Lofoten Islands of Norway furnished the largest portion and best quality of medi-

cinal oil. Iceland has become an important supplier in recent years, since the European supplies have been cut off. The price of U.S.P. cod liver oil at the start of 1942 was about $85 per barrel of 50 gallons. At the start of 1941 a barrel was quoted at $70.

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Fishskins

FISHSKINS are used frequently for making various types of leathers, the most important for the purpose being sharkskin.

Several species of sharks are skinned for leather raw stock. These skins have a rough, flinty outer armor, called the shagreen, which is removed before the skins are tanned. The tanning is done by a special process controlled by only one tanner in the United States and the finished leather is pliable, supple, durable, tough, and practically scuff-proof. Sharkskin leathers are popular for use as tips for children's shoes, for shoe uppers, and for luggage, men's belts, billfolds, and small leather goods. Sharkskin grains are frequently embossed on cattle hide, goat, and other leathers to simulate the genuine sharkskin leathers.

Sealskins are used to make a variety of small leather goods, belts, bill folds, etc. High grade sealskins are used for making pin seal leathers, in which the original fine grain of the sealskin is preserved.

The skins of sea lions, blackfish, dolphins, and porpoises are used in limited quantities for making special leathers for various purposes. The skins of tropical fish have also been tanned and used as fancy trimmings on high style shoes, but only in very limited quantities.

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Flander's Stone

See Graphite

Flaxseed

FLAXSEED, also known as linseed, is a product of the flax plant. This plant grows to a height of from 14 to 40 inches, has a distinct main stem and short taproot. The flax flower has 5 petals, and a 5 celled boll, which when filled, contains about 10 seeds. Flax is, as a rule, self-polinated, and very little natural crossing occurs. The petals are light blue, white and pink in different varieties and the seeds range from a yellow to a dark brown in color.

Flax is a dependable crop in localities that have an annual rainfall of 20 inches or more and in areas that are not subject to hot dry winds or extremely high temperatures when the flax is blooming, filling or ripening. A firm seedbed is necessary to provide a good stand, preferably on heavy soils that are reasonably free from weeds. Flax is not excessive in the use of plant foods. Actually, the average flax crop removes from the soil less phosphorus and potash and slightly more nitrogen than an average crop of wheat or oats.

The most destructive disease of flax in the United States are wilt, rust and pasmo. Wilt can be largely controlled by growing wilt-resistant varieties, and by early planting. Rust and pasmo are less easily controlled, but some of the varieties now grown are partially resistant to rust. New varieties combining wilt-resistant and rust-resistant qualities are being developed and will soon be released for general use.

Argentina is the world's largest producer. Other important producing countries are the United States, Russia, India, Paraguay and Canada. World production in the five years prior to the war averaged about 135 million bushels, of which Argentine accounted for about 43 percent.

Flaxseed is grown chiefly in the United States in Minnesota, North Dakota, South Dakota, Montana, Iowa and California. It

is also grown to a limited extent in Kansas, Nebraska, Wisconsin, Michigan, Missouri, Idaho, Arizona, Texas, Oregon, Washington and Oklahoma. In the Northwest the crop is usually seeded in late March and early April and harvested in the latter part of July and in August.

The United States does not grow enough flaxseed for domestic needs and imports are provided chiefly by Argentina and Uruguay. Production in 1941 amounted to 31.5 million bushels, however, testifying to the potency of government efforts to stimulate domestic production. The production goal for 1942 called for the seeding of 4,500,000 acres against 3,367,000 acres in 1941.

In some countries, especially Russia, flax is grown chiefly for its fibre, which is made into linen. There the plant is harvested before the seeds ripen, and oil is crushed from the seed only as a by-product.

But in other countries, particularly in the Americas, flax is grown chiefly for the seed from which linseed oil is expressed. The marketing unit is the bushel.

Farmers usually sell their flaxseed at harvest time, keeping only a sufficient amount for next season's need. The elevators, as a rule, make shipments to the terminal markets as soon as enough seed has been accumulated to make a carload. Most of the flaxseed is stored at the terminal markets or at the plants of the linseed processors.

The marketing centers for domestic flaxseed are Minneapolis and Duluth. The bulk of the flaxseed marketed at Minneapolis is crushed in that area, but the flaxseed marketed at Duluth is usually shipped to linseed processors located in Milwaukee, Chicago, Cleveland and Buffalo via the Great Lakes. Flaxseed produced in California and other far western states is crushed and the products consumed in that area.

Flaxseed was quoted at about $2.50 per bushel at Minneapolis early in June, 1942.

Sales of Argentine flaxseed are practically always consummated prior to arrival at New York. When the shipment reaches New York, the flaxseed is unloaded directly at the buyer's plant if steamer unloading facilities are available, or into barges that are towed to the buyer's plant for unloading.

Some large-scale consumers in the United States obtain Argentine seed through brokers at Buenos Aires. These brokers buy the seed, arrange for its storage and transportation to the ports and ship it to New York. The consumer provides the broker with funds to carry on these operations and pays him a commission for his services. Imports of Argentine flaxseed are consumed chiefly in the New York area, in Philadelphia and occasionally in Buffalo.

Under present practices, the official standards of the United States for flaxseed are based on quality factors such as test weight per bushel, percentage of damaged seeds, dockage, moisture content and condition of seed. These factors are of value in determining the net weight, soundness and storage qualities of flaxseed. The inspection of flaxseed is carried out by licensed government inspectors according to the respective grade requirements of the following standards.

Grade No.	Minimum Test Weight per Bushel	Maximum Limits of Damaged Flaxseed
1	49 pounds	20 per cent
2	47 pounds	30 per cent
Sample	Sample grade shall include flaxseed which does not come within the requirements of the grades No. 1 or No. 2; or which contains fire-damaged flaxseed; or which contains more than 11 per cent of moisture, or which is musty or sour, or heating, or hot, or which has any commercially objectionable odor, or which is otherwise of distinctly low quality.	

The chief substitutes for flaxseed are other oil bearing seeds.

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Flint

USED by the ancients for tools and not so many years ago an important part of a soldier's equipment, flint is no longer widely used or extremely important in United States industry. In a limited way, in competition with numberless other materials, it is utilized in the abrasive field, in pottery and glass manufacture and in building.

It is an impure variety of chalcedony, or quartz with a hardness of 7 which will strike sparks from steel. It runs as high as 99 per cent silica and is crystalline in structure.

Flint grinding pebbles occur in the beaches, derived from flint bearing chalk cliffs on both the English and French coasts. France and Denmark have been the only exporting countries with England's production insufficient for her own needs.

Naturally the war has brought imports to a virtual halt. In 1940, 2,840 tons of flint, flints and flint stones, unground, valued at $32,397, were imported. This contrasted with 11,987 tons valued at $116,019 in 1939.

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Flour

See Wheat Flour

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Fluorspar

THE largest consumer of the mineral, fluorspar, is the steel industry; from five to eight pounds of fluorspar concentrates are used in the production of a ton of steel. Fluorspar's composition is CaF_2, hardness—4; specific gravity—3.01 to 3.25; color—white, yellow, green, rose, violet blue and purple.

It is mined in largest quantities in southern Illinois, Kentucky, Colorado, New Mexico, Arizona and Idaho. Approximate total United States production of all grades is 297,800 short tons. The war sharply curtailed imports, which in 1941 amounted to only 7,589 short tons.

In addition to its large use by the steel industry, this mineral is also used in the manufacture of hydrofluoric acid and in the glass and enamel trade. Its war importance was varied. Acid Grade Fluorspar is used in the manufacture of artificial cryolite which in turn is of great importance in the production of aluminum. Fluorspar ore is also used directly in the electrolytic process of the aluminum industry. There are numerous other uses for fluorspar in manufacturing other commodities.

The marketing unit is the short ton. Following are the ceiling prices placed on Jan. 2, 1942: Metallurgical Grade, $24.00 to $25.00 per short ton; Acid Grade, $26.00 to $32.00; Ceramic Grade, $33.00 to $34.00. The price differentials for the different grades are fairly rigid.

General method of transportation from producer to consumer is by boat and rail in bags (paper or cloth); in bulk in paper lined box cars and covered hopper cars. The original raw material maintains merchantable quality for an indefinite period of time. There are no substitutes listed.

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Formaldehyde

FORMALDEHYDE is a colorless gas which commercially is offered in water solution. The most common concentration is a 37 percent solution, also known as formalin. Methyl alcohol is present in the commercial solution in small amounts to prevent polymerization of the formaldehyde. Production of formaldehyde is accomplished by passing methyl alcohol vapor and air over heated copper or platinum gauze.

The production of formaldehyde in the United States during 1940 totaled 75,368,804 pounds. Sales in that year amounted to 60,632,757 pounds, valued at $3,571,439.

Formaldehyde output in 1939 was 134,478,-827 pounds; and sales 91,159,551 pounds, valued at $4,060,666. It is packed in 400 and 450 barrels 125 pound kegs; 50 and 100 pound carboys; jugs and demijohns varying from 8 to 40 pounds in weight; and smaller bottles. Formaldehyde is also sold in tankcar and tank-truck shipments.

Formaldehyde is the simplest member of the aldehyde series, and because of its strong reducing qualities is widely used in chemical and other industrial processes. It also is employed in embalming fluids, for the preservation of biological and anatomical specimens, for hardening photographic films and protein materials, and as a germicide and antiseptic. In recent years, large amounts of formaldehyde have also gone into the manufacture of the phenol-formaldehyde resins, and as a raw material into the earlier stages of urea resin production. The price of formaldehyde in tankcar quantities in recent years has been 4¢ per pound. The price in drums and barrels has been slightly over 5¢ per pound.

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Formalin

See Formaldehyde

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Fossil Wax

See Ozokerite

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Fullers Earth

FULLERS EARTH is a natural hydrous aluminum silicate of a light gray color. It has a greasy feel. Its physical properties lend themselves to giving a high bleaching property for oils, waxes, etc. Calcined Fullers Earth (nearly 100% of the total production) does not slake or powder in water. This is particularly true in the coarse grades as it is used for moisture removal in many products, e.g. gasoline, gases, etc. It adsorbs the basic colors in organic compounds. In the raw state, it occurs in large uniform clay beds and is mined from open pits by steam shovels. The principal areas of supply are Florida, Georgia, Texas and Illinois. About 150,-000 tons are produced in the United States annually. Principal users of fullers earth are the petroleum and vegetable oil industries, which account for approximately 95% of the annual production. It is used for bleaching and clarifying oils and industrial solvents. Shipment is in carload quantities with approximately 60% moving in bulk and the balance in 125-pound burlap bags. The price is quoted in ton lots; May 1942 quotations were about $16.50 per ton.

Usually, it is delivered in standard hopper and box cars by railroads directly to the consumer. As delivered by the processor, it will keep almost indefinitely without hindrance to quality. Fullers earth is marketed in two grades, granular and fine, with the latter used for contact filtration and the former for percolation filtration. The granular grade is produced in several standard mesh sizes to meet consumer demands. The raw supply is not limited and therefore the possibility of a substitute is remote. This commodity's importance in the war effort is through its use for bleaching and purification of gasolines and motor oils which are used in airplanes, diesels, etc.

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Galena

See Lead

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Gambier

A YELLOWISH catechu derived from a Malayan woody vine (Uncaria Gambir). It is sometimes called yellow, or cubical,

catechu or terra japonica. Natives chew it with the betal nut.

Although exact statistics on imports into the United States are not available it falls among the catechol tannins, used for preserving hides and leather.

The war has interferred with the source of supply from the Far East and only a nominal market exists.

A patent cutch, or prepared cutch, is processed by melting gambier with potassium dichromate, producing, for dyeing, redder shades than gambier alone.

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Garnet

An abrasive mineral with a "hardness" range of from 7½ to 8; usually deep red but often of another color. Mostly marketed as precious stones, under another name because of the low price of the common, abrasive varieties. Sharp, hard, tough, with slivery grain shape. Principally used for coating of abrasive paper and cloth. It is marketed by the ton and pound with "concentrates" ranging around $70.00 per ton and "grain" at from 3¢ to 10¢ per pound. It is like most metals, non-perishable, and is transported by rail, truck and boat. The price varies with the grading or size; "concentrates" ranging from ½ inch down, unsized, while "grain" is accurately graded and uniform. Other, and artificial, abrasives serve as substitutes.

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Garnierite

See Nickel

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Gas

Approximately 1,500 gas companies in the United States supply service to more than 18,675,000 customers using gas in their homes and places of business. The industry employs 138,200 persons and pays to Federal, state and local governments $109,843,000 on taxes.

The production of gas for commercial purposes offers distinctly different problems in the field of natural gas as compared with that of manufactured gas. With natural gas, the only problem is the location and capture of the trillions of cubic feet already manufactured by nature and stored underground. With manufactured gas, the problem is that of invention and development of machinery to produce it most economically from raw materials in the quantities necessary for commercial usage.

Coal gas, carburetted water gas, and oil gas are the three kinds of manufactured gas which are ordinarily used for utility distribution. Other kinds of gas are manufactured and used in certain commercial and industrial processes.

Gas fields and fields that produce both gas and oil are widely distributed over certain areas in the United States. At the present time, there are at least 24 states in which natural gas is being produced and marketed in commercial quantities: Arkansas, California, Colorado, Illinois, Indiana, Kansas, Kentucky, Louisiana, Michigan, Mississippi, Missouri, Montana, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Washington, West Virginia and Wyoming. The gas-producing areas in these states may be grouped together into certain well-defined fields which have been given distinctive names: Appalachian, Mid-Continent, Amarillo, Monroe, etc.

Although nature still may be manufacturing natural gas, the process is so slow that no reliance on additions from this source can be considered in determining the life of natural gas supply. It seems to depend entirely upon the rapidity with which gas is withdrawn from existing supplies.

Due to advances in scientific knowledge,

it is possible today to estimate the gas reserve of a given field quite accurately.

Forward-looking natural gas companies have secured control of sufficient gas reserves to assure their customers of an adequate supply of gas for at least twenty years. There are companies whose proven reserves have a life of thirty years and which in addition either own or control undeveloped but promising acreage which may furnish a supply of natural gas for many more years.

The assurance of a continuing future supply is indicated by the tremendous reserves of natural gas now in sight in presently known and developed, or partially developed, reservoirs, together with incomplete development of the territory surrounding these reservoirs. The possibilities and probabilities of discovering additional reserves, even in areas completely removed from present known production, are continually increasing due to greater knowledge and improved technique in geology and geophysics and to improvements in drilling and production practices. Scientific advancements not only lead to discovery of new fields but also to the recovery of gas from deeper strata. Recent advances in conservation of gas both in dry gas fields and in oil fields, by decreasing the amount of gas produced with oil, constitute a further assurance of greater and longer supply of gas.

Because of the number of unknown factors, it is impossible to give an accurate estimate of the future life of natural gas service but it is certain to be many years.

Natural gas, as it comes from the wells, does not contain all the impurities or byproducts present in crude manufactured gas; nevertheless, it contains constituents which either are not valuable as fuel or which would condense gradually and drop out of the gas in transmission through the long distances ordinarily covered in natural gas transmission systems.

Gas produced from wells where oil also is produced is saturated with gasoline vapors. Extraction by pressure and cooling of these vapors produces "casinghead" gasoline, a highly volatile gasoline. Other gases chemically known as propane, butane, and helium are obtained in like manner. The first two of these are familiar to the public and used under the trade term, "bottled gas." Helium is a non-inflammable, very light, gas used for the inflation of dirigible balloons. Its non-inflammable quality combined with its lightness makes it particularly desirable for this purpose. As the United States has a practical monopoly of the world's known sources of helium, it has a great advantage over other nations in this respect.

Manufacture of coal gas involves distillation of the coal, cooling and consequent condensation and removal of certain impurities, scrubbing or washing to eliminate other impurities, and purification to remove the final undesirable gaseous constituents.

Coals vary widely in suitability for gas making, due to chemical differences. Bituminous yields most of the suitable varieties. Anthracite is a sort of natural coke from which the volatile constituents necessary for gas making have already been driven, leaving little or nothing for gas. Lignite contains too much oxygen and water.

The term "water gas" is a misnomer, but was used by early gas engineers to distinguish it from coal gas which was already in extensive use. It is made by passing stream through incandescent hot coke or anthracite and adding oil gas to enrich or carburet the water gas thus produced.

Oil gas is made much as carburetted water gas, except that oil is the fuel.

Some gas plants recover more of the by-products than others. Coke is always produced in the manufacture of coal gas. Tar is a by-product both of coal gas and carburetted water gas. Raw, it is used for

road-building, waterproofing, and other purposes. It is also the source of many delicate perfumes, and of dyes, valuable oils and many drugs and chemicals. Lampblack is an important by-product of oil gas manufacture; other by-products include ammonia, light oils, naphthalene, etc.

When manufactured gas is ready for the use of the customer, it is stored in holders to meet the demand. Similarly, nature stores her product, natural gas, over millions of years waiting only to be tapped. From this point on, there is little difference in the means and methods by which either form of gas is conducted to the place of use. In fact, the same facilities for one may be, and frequently are, used later for the other.

The gas, whether manufactured or natural, is conducted from the place of storage through buried pipes, called transmission and distribution mains. There really is no difference in material and construction between transmission and distribution mains. Pipes of comparatively large size carrying gas at high pressures for considerable distances without being tapped usually are referred to as transmission mains; the lower pressure pipes from which the supply is tapped frequently and directly usually are called distribution mains.

Transmission mains may be from a few miles to a thousand or more miles long. The pressure carried may be anywhere from five to several hundred pounds per square inch. Most of the very long transmission mains are for natural gas as it is frequently found at quite long distances from the places where the large markets exists. For example, pipe lines extend from the Amarillo Field in Texas to Denver, Minneapolis, Chicago, Detroit, Kansas City, etc.; from the Monroe Field, lines run to Houston, Memphis, Atlanta, New Orleans, Mobile, St. Louis.

The gas industry is taking a leading part in supplying the vast industrial heating needs of factories and mills that are producing the thousands of parts for equipment and machines necessary in the war program. For hardening the small and intricate parts of machine guns to the final heat treatment of the largest guns, specially designed gas furnaces are speeding production at an ever increasing pace. In the navy yards, some of the largest industrial furnaces ever built are annealing fully assembled gun turrets with gas. Equipment which has been developed for peace-time uses during the last decade through cooperative research and engineering by the gas utilities and leading equipment manufacturers under the sponsorship of the American Gas Association is rapidly being put to work to speed up production in war industries.

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Gasoline

See Petroleum

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Gelatin

This translucent, tasteless, organic colloid is valued especially for its property of dissolving in hot water and forming a transparent jelly upon cooling.

Its raw materials are the animal products calfskin, pigskin, and ossein. The calfskin used is principally of domestic origin and the pigskin almost entirely so. Ossein is an intermediate animal product obtained by the acid leaching of degreased bones, washing and drying. This material can then be stored indefinitely. Before World War II most of the ossein was imported, largely from Belgium.

Gelatin is produced by extracting the above raw materials with hot water. Several runs are made, successively requiring a longer time and a higher temperature and yielding a liquid of less gelatin value than the

preceding one. The gelatin liquor is filtered, concentrated by evaporation, chilled on a belt, dried in a tunnel drier, and then ground. Successive runs are then blended to obtain any desired grade or test.

Massachusetts, accounting for over two-thirds of U. S. production, is the chief area on account of proximity of raw materials and pure water. Other areas are Wisconsin, Illinois, New Jersey, New York and Michigan.

Imports of the edible variety formerly represented a considerable fraction of U. S. consumption of gelatin. By 1939, however, this had dropped to 9% and by 1940 imports had almost entirely ceased, owing to war conditions. Photographic gelatin imports have also fluctuated widely, being one million pounds in 1937, but declining again in 1938 and 1939. Since then imports have been very small and may remain so for the duration of the war because they came largely from Germany. Inedible (technical) gelatin imports in 1938 totaled only 54,000 lbs.

According to the U. S. Tariff Commission's Report No. 135, Second Series (1940), p. 84, "the edible gelatin division of the industry is substantially more important than the inedible (technical) and photographic gelatin divisions, since it accounts for the bulk of the production and sales of all kinds of gelatin. Plant capacity for producing edible gelatin in 1938 was reported to have been about thirty million pounds annually compared with about seven million pounds for inedible and photographic gelatin combined." In the same year the production of *inedible* gelatin reported to the Tariff Commission was about two and one-third million pounds.

Photographic gelatin production statistics are not divulged nor are any 1941 figures available for edible gelatin. From 1938 total plant capacity figures, it is likely that the 1941 production of all types of domestic gelatin was upwards of thirty-seven million pounds.

Gelatins are divided by the trade into three types — edible (food), photographic and inedible (technical).

Edible gelatin is the main ingredient of desserts of the jello type. It forms about 80% of domestic gelatin production. This variety must be made from clean materials under aseptic conditions and must be free from objectionable color, odor, bacteria, and harmful substances of all kinds. Edible gelatin had the following distribution in 1935 among consuming industries:

Jelly dessert powder	53.6%
Ice Cream	13.6%
Candy	11.0%
Biscuit	5.2%
Meat — packing and dairy products	4.3%
Miscellaneous	12.3%
Total	100.0%

Photographic gelatin possesses high jelly-strength. Iron, copper, and lead must not exceed about fifty parts per million. It is used in the preparation of sensitized coating ("emulsion") for photographic plates, films and papers.

Technical gelatin is any non-edible glue or gelatin with a color light enough and a jelly-strength high enough for the use intended. The uses are as a general adhesive, as a sizing or stiffening agent for paper, hats, textiles, etc., and as an ingredient of calcimines, printers' rollers, mimeograph mass, electrolytic metal refining and electroplating solutions etc.

Gelatin is marketed in original fifty pound paper bags or two hundred and fifty pound lined wooden barrels. Quotations are in cents per pound. It is transported from producer to processor by boat, rail and truck in bags or barrels. If kept dry, it will maintain its original quality and grade indefinitely.

Edible gelatin is produced in various grades, distinguished chiefly by jelly strength, but the grades almost invariably are blended before sale to conform to grades maintained by each producer or to yield the particular

quality of gelatin desired by the consumer. In the U. S. edible gelatin is marketed principally in powdered form, photographic and technical in flaked form; in foreign countries large quantities are also sold in sheets.

Photographic gelatin is not made or sold according to grade or specifications because the consumers keep the latter a secret. Hence this kind of gelatin is not sold in the open market, but all transactions are on an experimental sample basis and photo-processors often blend many batches of photographic gelatin to obtain the uniform quality they desire.

Technical (inedible) gelatin differs from the edible variety in that it may contain certain impurities not permitted by Federal law in food gelatin. It differs from photographic gelatin in several characteristics. Technical gelatin is of two principal kinds: sizing gelatin and pharmaceutical gelatin, the latter being higher in price.

Sizing gelatin was practically all obtained from France before World War II. Pharmaceutical gelatin is mainly used in the preparation of capsules. It must be sterile and tough.

Edible gelatin, because of its unique physical properties, meets with very little competition. In the ice cream industry sodium alginate, a vegetable stabilizer has been used as a substitute. *Photographic* gelatin has no competitor. *Inedible* (technical) gelatin used for sizing runs up against vegetable sizes such as various kinds of starches. Since these are often cheaper than gelatin, the latter is chiefly used for special purposes. For capsule gelatin there is practically no substitute.

Imports of gelatin, whether edible or inedible, are dutiable in two value brackets, those valued (a) at less than 40 cents per pound, and (b) at 40 cents or more per pound. Since 1933 photographic gelatin has been classified as edible gelatin.

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Geranium Oil

GERANIUM OIL is a pale yellowish or greenish liquid with an agreeable rose-like odor, obtained by distilling various species of the herb Pelargonium, which are extensively cultivated in Northern Africa, Southern France, Spain, Reunion, Italy and Corsica. Usual commercial grades are termed Algerian, African, Reunion, Turkish, Spanish and Bourbon. A French geranium oil of superior fragrance is the most expensive. Rose geranium oil is produced in France by adding rose petals to the Pelargonium herb in the distillation process.

Imports of geranium oil in 1940 totaled 164,301 pounds, valued at $324,074. Most of the year's importations came from Algeria and other French African colonies. In 1939 the imports totaled 227,479 pounds, valued at $472,487. In that year French Africa other than Algeria supplied 125,001 pounds; Algeria, 66,139 pounds; and France, 22,661 pounds. Commercially geranium oil is usually packed in tin canisters of 25 pounds. An extra fine Spanish oil is encountered in 10-pound tins, however, and the Turkish product in original pots weighing 30 kilos.

Geranium oil is one of the most popular perfume oils. It is employed in perfuming many toilet preparations and in the blending of numerous floral bouquets. The odors of many of the fine toilet soaps also contain liberal amounts of the oil. Pricewise, on June 1, 1942, Bourbon geranium oil cost $24.00 per pound. At the start of 1942 the Bourbon variety was priced at $17.00; and at the same time in 1941, $14.00 per pound. The Algerian rose geranium oil on June 1, 1942 was priced at $30.00 per pound; on the first of 1942 at $17.00; and on the first of 1941 at slightly over $14.00 per pound.

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Gin

See Distilled Spirits

Glass

The raw materials of glass making cover almost all the known chemical elements, but principally they are sand (SiO_2), Limestone ($CaCO_3$) and Soda, used as Soda Ash (Na_2CO_3) and Salt Cake (Na_2SO_4), Potassium Carbonate (K_2CO_3), Potassium Nitrate (KNO_3), Boric Acid (B_2O_3) and Borax ($Na_2B_4O_7$) and scattering quantities of coal, lead, barium, uranium, arsenic, antimony, etc.

Most of these materials are procurable from original sources within the United States, and only very few are imported.

Silica Sand for glass making is produced extensively in several different localities, notably the Atlantic Seaboard, the Allegheny Mountains, the plains about Ottowa, Illinois, the Ozark Mountains and several localities farther west. It is usually purchased on a specification basis covering especially the iron and alumina content, and the grain size and moisture. As a rule, it is shipped in open hopper cars or gondolas, where the moisture content is not exacting, and in box cars where moisture content is an important factor. The usual carload is about 100,000 pounds.

Limestone is available in large quantities in many different localities. It is used as the raw stone, as hydrated lime, and as precipitated calcium carbonate. The principal sources of supply are found in Delaware, Maryland, Ohio, Michigan and Pennsylvania. It is a standard commercial product bought to specification, in standard carload lots. The specification covers total calcium, iron, alumina, moisture and CO_2 content. Usually it is shipped in box cars.

Soda Ash (Na_2CO_3) is purely a chemical product. It is very pure as originally produced, but is also bought to specification as with the other materials. Total alkali and CO_2 are the important items here, though the restrictions on iron and other extraneous materials are quite rigid. It is procurable from any of the major chemical manufacturers in Ohio, Delaware, Michigan, Missouri, New Jersey and New York. Usually shipped loose in standard box cars, in carload lots.

Salt Cake (Na_2SO_4) is also purely a chemical product, and is obtainable from any of the major chemical manufacturers in California, Delaware, Illinois, Indiana, Louisiana, Massachusetts, Missouri, New Jersey and New York.

The Potassium salts fall into the same class with the Lime and Soda materials, and are obtainable from much the same sources, and under much the same conditions as to shipping, etc.

Borax and Boric Acid are natural mineral products mined chiefly in California and purified by recrystalization. It is procurable from numerous sources, including those mentioned for other chemicals. Coal as used in glass making is principally that easily available in the particular district. It is used only in small quantities, to aid in removing traces of sulphur and sulphides left by the decomposition of salt cake.

The other materials are used in such quantities that barrel shipments are usually employed. Most of them are native products available in various parts of the country. Some of them, particularly Lead, Barium and Borax increase in importance as the need for Optical Glass for military purposes increases.

The purity of the raw materials, operating skill, including the technique of mixing are determining factors in the producton of satisfactory glass products. The production is rather wide spread over the whole country, with a certain rather indefinite allocation of a particular type of product to a particular territory. For example, pressed and blown ware is produced by one factory in Arkansas; four in California; one in Canada; four in Illinois; nine in Indiana; one

each in Maryland and Massachusetts; fourteen in New Jersey; eighteen in Ohio; four in Oklahoma; twenty-three in Pennsylvania; one each in Rhode Island and Texas; and thirty-six in West Virginia.

Bottles and hollow ware are produced by five factories in California; two in Canada; one in Florida; four in Illinois; seven in Indiana; one in Kansas; four in Maryland; one in Mississippi; seven in New Jersey; four in New York; five in Ohio; six in Oklahoma; fifteen in Pennsylvania; one in South Carolina; two in Tennessee; two in Texas; one in Washington; and seven in West Virginia.

Window glass is produced only in seven states. There is one factory each in Arkansas, Indiana, Louisiana and Oklahoma, three each in Ohio and Pennsylvania; and five in West Virginia.

Plate Glass is produced in ten factories which are distributed one each in Michigan and Minnesota and Missouri; four in Pennsylvania; two in Ohio and one in Illinois.

A number of factories rather widely scattered, produce severally wired, opalescent, fancy figured, rough and ribbed glass, glass tile and fibre glass. Wire glass is produced at eight different factories located one each in Tennessee, Missouri, California and Oklahoma; and four in Pennsylvania.

Opalescent and colored glass are produced by eight separate companies, operating factories in four different states, while one factory produces glass fibres and one produces a specialized form of figured glass for railroad use.

Laminated safety glass is produced principally by seven different companies operating nine assembly plants located three in Pennsylvania; two in Michigan; one each in Canada, Illinois, Ohio and Missouri.

Window glass production in 1941 amounted to 16,554,000 boxes of 50 square feet of glass per box. The output of plate glass in 1941 was 190,404,000 square feet.

Most of the production of window glass goes into domestic glazing. During normal times, about 80% of the nation's plate glass is used in automobile glazing and from 10% to 15% is used in the production of mirrors. The curtailment of automobile production and civilian construction has diverted glass output to war purposes. War construction is absorbing large quantities of window glass. Special types of glass are produced for aircraft, tanks and other implements of war. Owing to plentiful supplies of raw materials and the curtailment in civilian uses, glass production is expected to be ample for all needs during the war.

Window glass is sold in boxes of approximately 50 square feet. Plate glass is sold by the square foot. Glass is transported in boxes by rail, truck or boat. The principal types are plate glass, window glass, glass blocks and structural glass. Owing to the surplus of raw materials, substitutes are not likely to play an important part in the glass industry during the war.

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Glass Spar

See Feldspar

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Glazed Brick and Tile

"GLAZED brick and tile" are structural units produced in the following face sizes: 2¼" x 8", 5" x 8", 5" x 12", and 8" x 16¼". The wall thickness of such units vary, depending on the thickness of the wall desired. The material is produced in three distinct types of glazes:

1. *Ceramic Glazes:* Ceramic glazes are compounded of chemicals thoroughly ground together and sprayed on a previously formed fire clay body. The spray unit is then burned at a temperature over 2,000° F. which fuses the glaze to the body in such

fashion that it is impossible to separate the two, as their co-efficients of expansion are identical and hence the glaze becomes an integral part of the body.

2. *Salt Glaze:* Salt glaze is applied to a fire clay body as a vapor while the units are at a temperature over 2,000° F. The resultant glaze, being transparent, presents the color of the fire clay body — gray, cream, or buff. Salt Glaze (sodium iron silicate) is smooth, lustrous, (image reflecting) resists pencil or chalk markings, and is one of the oldest known forms of glazing.

3. *Clay Coated:* Clay coated is a high grade smooth unit manufactured from fire clay. Its vitreous applied surface is non-absorbent and light diffusing. It is available in a variety of colors.

The fire clay which forms the body of the unit is ordinarily mined, and the unit is formed or processed like brick or structural clay tile. The glazes are then produced and applied, as explained above.

Production of glazed brick and tile is concentrated principally in the states of Ohio, and Indiana, Pennsylvania, and Illinois, although there are also plants on the West Coast, and in the South West.

In 1941 the industry shipped approximately fifty-three million glazed brick and one hundred and seven million glazed tile, measured in brick equivalent. These shipments were far below the actual capacity of the Industry.

In addition to their strictly utilitarian structural function, glazed brick and tile offer superior sanitation and light reflection qualities. These qualities have made the use of glazed materials desirable in hospitals, schools, and public buildings in general, as well as in industrial and food processing plants. Because of the wide range of colors and finishes available, the material offers unlimited design possibilities.

Glazed brick and tile are quoted by the thousand. Price is dependent on too many factors for general quotation. Transportation is by rail and motor truck. All A-Grade Units are shipped in cardboard cartons or trays. Other grades are B-Grade and Off Grades.

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Glazed Tile

See Glazed Brick & Tile

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Glucinum

See Beryllium

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Glucose

See Corn Sugar

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Gluten Feed

AMONG the by-products from the processing of corn for its starch are gluten feeds and meals. The United States corn refining industry, in 1941, produced about 850,000 tons of feeds as compared with 624,000 tons in 1940 and an average of just over 500,000 tons in the four-year period, 1936-1939. Most of the production is corn gluten feeds, consisting of gluten, fibre, soluble mineral salts and other nutrients. About 40,000 tons are in the form of oil or oil cake meal, recovered after pressing the oil from the germ or embryo.

After the gluten is separated from the raw corn starch in the refining process (see corn starch), it is collected with water in large settling tanks where it stands until the gluten settles to the bottom. Then the water is drawn off and the thickened gluten is pumped through filter presses to get even more water out of it. The final by-product operation combines the three by-products already obtained in the refining process — the steepwater, the hulls and fibre, and the gluten—

and makes "corn gluten feed" of them. The gluten is mixed with the hulls and fibre and the result sprayed with concentrated steep-water to give it added minerals for nutrition value.

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Glycerine

AT THE current rate of production, the United States, it is estimated produces about half of the normal world's supply of glycerine. In 1940, for example, this country produced over 196 million pounds of crude glycerine (80 percent basis), a marked contrast to the 1920 production of 54 million pounds. Practically all of this glycerine was further refined to produce the grades required by the various industries.

In the United States and in other nations, under normal conditions, nearly all the glycerine available is obtained as a by-product of the soap and fatty acid industries, with the former definitely predominating. Excepting certain very essential quantities of "lauric acid" oil, e.g., coconut, palm-kernel and babassu oil, required in the manufacture of high quality soaps, the fats and alkalis necessary for the production of soap, and hence of glycerine, are domestic products.

Since the supply of glycerine is dependent mainly upon the production of soap, any factor influencing soap raw materials would in turn effect the availability of glycerine.

The two commercial grades of crude glycerine are "soap lye" glycerine, from the soap industry, containing about 80 percent glycerine, and "saponification" grade, from the fatty acid industry, containing about 88 percent glycerine. They are generally referred to as "80 percent soap lye crude" and as "88 percent saponification crude," respectively.

Federal Specifications divide refined glycerine into three basic grades: Grade A—"S.U.S.," Grade B—"High-gravity" ("Dynamite glycerine"), and Grade C — "Yellow distilled."

U.S.P. or Chemically Pure glycerine is a high grade, water-white product meeting the requirements of the United States Pharmacopoeia. It is used in foods, pharmaceuticals, cosmetics or for any purpose where the highest quality is demanded.

High gravity and dynamite glycerine are intended for industrial uses where high gravity glycerine is required. These grades contain about 98.5 percent glycerine and have a specific gravity of not less than 1.2620 at 15.5° C.

Yellow distilled is a yellow glycerine for industrial purposes in which high gravity and light color is not required. Such grades according to Federal specifications, should have a specific gravity of not less than 1.2550 at 15.5° C.

In commercial practice a distinction is made between high gravity glycerine and dynamite glycerine. The former is of light color for specific industrial uses, whereas the latter is of straw color as made especially for the explosives trade. In peace times, chemically pure glycerine constitutes about 60 per cent of the total refined output and dynamite and other grades about 40 per cent. In war time these figures are radically changed because glycerine is one of the essential ingredients of explosives and a great variety of other munitions.

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Goatskins

GOATSKINS were one of the earliest forms of animal skins to be used for making leather, following closely after the tanning of wild animal skins and probably preceding by a number of centuries the use of cattle-hides and calfskins.

In modern commerce, the skins of goats and kids of many breeds are in great demand for the manufacture of soft leathers. Before

the war, goatskins constituted about 35 percent of the total importation of hides and skins over a long period of years, as practically all of the goat and kidskins used by tanners in the United States must be imported, coming from widely separated parts of the world.

Approximately one-third of the world's goatskin requirements are normally supplied by British India, chief goatskin producer of the world. The second largest normal goatskin producer is China, which before the unsettled conditions of recent years furnished about 8½ percent of the world supply. Goatskins for leather are also obtained in substantial quantities from South America, Mexico, Africa, the East and West Indies, and various countries in Europe and Asia.

Because goatskins are gathered from widely separated sections in countries spread throughout the world, they vary greatly in type and considerably in quality and value. The various types of goatskins are identified in commerce by the names of the countries in which they originate; the district of origin, takeoff, or shipment; and sometimes by the manner of take-off.

Goatskins are gathered by natives in the producing countries and are cured by wet salting, dry salting, sun drying, or pickling in a salt brine, the pickled skins often being shipped in the pickle brine in large casks. After native curing, the relatively small lots of skins prepared by local producers are collected at a central point—usually a port or major shipping point, where they are frequently subjected to some additional curing, and where they are graded and sorted for shipment.

Before the war, India, China, and the Netherlands ordinarily supplied about 50 per cent of the goatskins imported by the United States. European goatskins at one time accounted for 12 percent of our imports, but in the past decade or so these imports have sharply declined and have been replaced by shipments from Africa, Nigeria, British East Africa, and British South Africa.

The normal requirements of the United States for goatskins have averaged just under 40 million skins annually. Because of the fact that domestic goatskin production is practically nil and goatskin imports come from many parts of the world where shipping lanes are blocked or threatened by the enemy, future supplies are dependent almost wholly on the trends of the war. Because of this, and because of the fact that goatskin leathers are extensively used for making garments, gloves, etc. for the armed forces, the War Production Board has required tanners to set aside all skins of specified grades for manufacture into leather for military purposes. Furthermore, the Government has also restricted the quantities of raw skins which may be put into soak, setting a quota for each month, based upon a percentage of 1941 production. Imports are also regulated by the Government.

The tanning of goatskin leathers in the United States began in Massachusetts around 1770 and within a few years goatskin tanneries were established in various other sections in the East. The recent value of goatskin leather production ranges above 44 million dollars annually and represents about 10 percent of the value of all domestic leather.

Early American goatskin leathers were known by the term "morocco," from the ancient Spanish city which was famous for its manufacture of fine goatskin leathers. Later, the industry produced goatskin and kidskin leathers by vegetable, alum, and oil tanning methods, the alum method following closely the methods employed in France in the making of French kid.

Following the introduction of the chrome tanning process, American tanners turned from the older methods and practically all goatskin leather today is tanned by the chrome process—and is known commercially as kid or kidskin leather.

The principal leathers made from goatskins and kidskins in the United States are: Glazed kid, suede kid, crushed kid, patent kid, lining kid, lacquer kid, and fancy kid (finished with gold, silver or other metallic finish, or printed or embossed in a variety of designs and patterns).

Kidskin leathers are used for shoe uppers, garments, gloves, leather goods, leathercraft, etc.

Cabretta skins, taken from a Brazilian hair sheep, are often classed commercially in the same group of skins as goat and kidskins. The hair of the cabretta is finer than that of a kid and the leather made from its skin is often smoother than calf leather.

* * *

Gold

STILL regarded by many as the best medium of exchange the world has ever known, gold has but a few comparatively unimportant trade and industrial uses.

Gold is an elemental metal (Au) found mostly in a native state. It is extremely heavy (specific gravity 19.36) and melts at 1945° F. Nitric, hydrochloric and sulphuric acids will not attack it but it can be dissolved by aqua regia. It is yellow in color, soft and the most malleable of metals. Because of its softness, it is usually alloyed with other metals, copper, silver or nickel.

It occurs principally on rock formations or in alluvial deposits. The latter is called "placer gold." In this form of deposit the gold is free and almost pure (sometimes slightly alloyed with silver), and is found in size of from small particles to large nuggets. These grains are often found mixed with gravel, sand or clay.

Gold alloys are largely employed for jewelry, the gold content of these alloys being expressed in karats, or parts of pure gold in twenty-four. For example, 14-karat gold would be composed of 14 parts of pure gold alloyed with 10 parts of various metals. The latter metals would vary in the proportion required to produce the desired color.

Its earliest use as a medium of exchange was due to the fact that it combined these appeals with extreme compactness of value, and it could be easily cut into standard quantities and stamped for purity. At times when peace could not be relied upon to make promises reliable over long times or wide spaces the medium of exchange had to be something of intrinsic value, easily carried to and from market, offered in trade as an actual commodity, and safely hidden or hoarded during social trouble. Its currency value came from its bullion value, and any drop in its buying power as coin was generally followed by its conversion back into bullion for refinement into ornaments, while any increase in the buying power of gold as coin (evidenced by a fall in general prices) was followed by a flow of bullion to the mint for coinage.

The early supplies of gold (and silver) for England and Western Europe, were brought from the Near East as a result of the Crusades, but when these ended and the Moors conquered most of Spain, this supply dwindled. The precious metals then appreciated, and to prevent the coinage being melted down for ornament, with consequent down-trend in staple prices, the mint price of gold was raised in England with every recoinage from about the middle of the fourteenth century to the end of Elizabeth's reign; and the last of these recoinages was at a mint price for gold three times as high as the first. Very broadly, this stepping up of the mint price was something equivalent to the mark-up of the U. S. Treasury buying rate for gold on February 1, 1934, from $20.67 per ounce of pure gold to $35.00. Similar mark-ups have been made by practically all European countries during nearly every century of social unrest, but except for

minor adjustments there has never been any corresponding mark-down in the history of western civilization.

The classical theory of the gold standard was based on the assumption that declining business, by lowering production costs, stimulates gold production and so restores the circulation, while rising business, by increasing the gold miner's costs, chokes back gold production and so causes a decrease in currency circulation, and in the credit base.

Actually, however, gold production is not very sensitive to business conditions.

In 1940, world production of gold reached the highest point in history, 41,560,000 ounces—a 3 percent gain over 1939. The United States production in 1940 was 5,984,163 fine ounces, compared with 2,628,775 in 1933. In 1941, after eleven years of successive increases in domestic production, a decline of 0.8 percent was recorded.

The Union of South Africa is the principal gold-producing country in the world (12,821,507 ounces in 1940) followed by the United States, including territories; Canada (5,322,857 ounces), and Russia (5,236,000 ounces in 1938). These four nations produce approximately 73 percent of the total world output.

In 1940, California was the leading gold-producing State, (1,443,889) followed by the Philippines (1,140,126) and Alaska (756,964). South Dakota, Colorado, Arizona, Montana, Nevada, and Utah were bunched together as producing sources with output ranging between 200,000 and 400,000 fine ounces. Lesser producing states were Idaho, Oregon, Washington, New Mexico.

Each year a quantity of gold is recovered from old jewelry, dental waste, scrap and other material received at private refineries and United States Mint and Assay offices. In 1939, the recovery from such sources was 895,096 ounces. During the same year, 1,108,256 ounces were sold for industrial use, the difference (213,160 ounces) representing the quantity of new gold used in the arts and industry.

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Grain Sorghums

IN VALUE and bulk the grain sorghums are important in the United States mainly in the great plains states of Texas, Oklahoma, Kansas and New Mexico. In much of this territory it would be impossible to develop farming enterprises without them as they take the place occupied by corn in the more humid sections of the country. Thus the sorghums provide essential feed grain and roughage for farm and range livestock and silage for the dairy and beef industries in these areas. Average acreage (1927-1936) devoted to grain sorghum production totaled 7,246,000 acres, upon which crops averaging 89,331,000 bushels were produced. The three states Texas, Oklahoma and Kansas produced over 85% of the United States total.

The chief factors affecting the production of grain sorghums are climatic, namely moisture and temperature. They can be grown successfully under lower rainfall than is required by corn but require higher temperature for both germination and satisfactory growth; hence their dominance among the crops in the dry areas where they are grown. The only important disease of grain sorghums are the smuts, of which there are three kinds, covered kernel smut, loose kernel smut and head smut. The principal insect enemy of the grain sorghums in the southwest is the sorghum midge. This pest affects the production of the grain only but is the limiting factor in the production of sorghum seed in parts of Texas and other important sorghum states. Two species of borers are of importance in the gulf and southwestern states.

The grain sorghums are grown primarily for feeding grains and fodder for farm use; only about 25% of the crop moves off the

farms where grown. Very little reaches the terminal market, since much sold off farms is consumed locally. The main terminal markets for sorghums are Kansas City, St. Louis, Memphis, Fort Worth and Galveston. The chief commercial uses of sorghum grain are similar to those of corn and it must compete with that grain. This means that sorghum grain if moving into commercial channels must be either better or cheaper than corn for the purpose desired. If cheaper it must be sufficiently so to pay for the longer haul and to overcome the handicap of a feeding value about 10 to 20% lower than corn. While some sorghum grain is used in the manufacture of industrial alcohol, it is used more extensively in poultry feeds, its size for this purpose being more suitable than corn.

Under the United States Grain Standards Act, classes and grades have been established for grain sorghums. The four important commercial classes being as follows: (1) Kafir; (2) Milo; (3) Durra and (4) Feterita. Kafir and Milo comprise more than 90% of the total sorghum grain graded at the principal markets. Three classes, Kafir, Milo and Durra are divided into two sub classes on the basis of color of kernels. Grain sorghums are a comparatively new crop in the United States. They resemble corn in composition and have similar uses in cookery, going into griddle cakes and hot breads resembling corn meal cakes or bread. They are, however, used mostly as a feed for farm animals on the farms where grown. At the present time they are also regarded as an essential ingredient of scratch feeds for poultry.

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Granite

A VISIBLE crystalline, igneous rock, granite is extremely hard and durable and will take a fine polish. Essentially it is quartz. The color ranges from whitish or gray to reddish-flesh. Granite's weight is about 170 lbs. per cubic foot and the specific gravity 2.7. It will not weather or crack as does limestone or sandstone and is therefore a valuable building stone. At one time, granite paving blocks were used extensively but this use has dwindled. More than 37 million paving blocks were made in 1925 against but 1,800,000 in 1940. One important use is for large rollers in pulp and paper mills.

In 1940, United States producers sold or used 10,880,580 short tons of granite valued at $21,621,943. In that year, 658,250 tons was sold as "dimension stone", i.e. cut to size. Rough construction took 89,040 tons of this total; Cut stones, slabs and mill blocks 1,104,590 cubic feet; rubble 239,560 tons; monumental stone 2,108,950 cubic feet; paving blocks 1,813,130 blocks; and curbing 569,290 cubic feet. Sales of granite as dimension stone declined 10% in quantity but rose 2½% in value in 1940.

In 1939, the total value of monumental granite produced in the United States was around $10,000,000 before fabrication. Of this total, Vermont produced $2,169,000, Massachuetts $1,320,730, Georgia $1,166,-000, Wisconsin $645,000 and Minnesota $645,000. With the possible exception of Massachusetts, where some building granite and paving blocks are produced in Chelmsford, a very large proportion of the dollar value was in monumental granite. Moreover, such states as S. Dakota, New Hampshire, N. Carolina, S. Carolina and Rhode Island yield monumental granite. Principal monumental granite centers, in order of importance, are: Barre, Vermont; St. Cloud, Minnesota; Elberton, Georgia.

Granite sales of crushed or broken stone totaled 10,222,330 tons in 1940, a 10% decline in quantity from 1939. This includes "riprap" used for walls and foundations. Noncommercial production made up a substantial part of this total — reported by city, county and State governments. North Caro-

lina led in 1940 in production of crushed stone with 2,387,130 tons. Georgia's output was reported as 1,863,460 tons and California, South Carolina and Virginia's production just topped a million tons each.

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Graphite

GRAPHITE is a natural variety of elemental carbon having a metallic luster. It is grayish-black in color and soft enough to mark paper. Although it is infusible, oxidation takes place at about 700° C. It is resistant to acids and alkalies, is readily molded and will conduct heat and electricity. High temperatures do not affect it. Pure graphite analyzes as carbon just as do coal and diamonds, yet strangely enough, the carbon of graphite is soft, unctuous and greasy feeling, while that of diamonds and coal is hard and abrasive.

Graphited metals—used chiefly as bearing metals—are usually produced by diffusing or sintering the powdered materials, after they have been compressed into molds.

Mexican mines produce the amorphous or non-structural type which lends itself to extremely fine pulverization; the crystalline from Ceylon continues to retain its crystal-like form even when ground; while the flake graphite from Madagascar holds its flat, fish-scale formation. Artificial graphite might be considered another classification. It is valued for its purity and is obtained by passing an alternating current through granular anthracite.

Foliated or flake graphite is used principally for crucibles and, in powdered form, as a lubricant, while the amorphous variety enters the manufacture of lead pencils, paint pigments, stove polish, foundry facings and electric brush carbons. Varieties containing as little as 35 per cent graphitic carbon are used for paints. For foundry facings, a finely ground "molding" graphite is utilized and this same product, mixed with metals to increase the capacity for electrical use, is used for brushes for motors and generators.

The uses of graphite are many and varied. Its inherent characteristics, which include its lubricating properties, its inertness, its refractoriness, color, electrical conductivity, the fact that it is tasteless and odorless, and others, are all employed by industry in one way or another.

World production of graphite back in 1935, the last year when fairly complete figures were available, approximated about 84,000 tons. Bavaria, Moravia and Austria were the largest producing areas but of a low grade variety consumed locally. The principal source of graphite in international trade has been Chosen—a large exporter of amorphous graphite and some flake too. Ceylon and Madagascar are other important sources as is Mexico. While Ceylon and Madagascar's output of the crystalline variety is substantial, Mexico produces the amorphous variety. In 1940, a joint marketing plan for Madagascar and Ceylon (to control the world supplies of high-grade graphite) was promulgated but collapsed. Japan has been a large buyer of the Ceylon output.

Latest United States production cannot be published. The average output in the 1925-29 years was 2,840 tons of amorphous and 2,133 tons of crystalline graphite. Alabama and New York—have been the principal producing states but the interference with shipments has brought about the renewed development of old and new deposits in those and other states.

In 1940, the United States imported 23,766 short tons of the amorphous variety valued at $487,675; 6,551 tons of flake valued at $340,396; 260 tons of artificial at $9,187 and 752 tons of lump, chip, and dust valued at $54,027. This was considerably more than was imported in immediate earlier years.

Graphite is the most important base of plumbago (also known as blacking and silver lead) and core wash. The purpose of these is to form a layer of refractory substance on the sand mold or core to prevent the molten lead from penetrating the sand. This layer produces the smooth, clean castings that are finally shaken out of the mold.

An order to "conserve the supply" of Madagascar flake graphite for use in the manufacture of crucibles, M-61, was made effective Feb. 17, 1942. Graphite—"Graphite or Plumbago: Amorphous natural (except of Mexican origin); Crystalline, flake; Crystalline, lump, chip or dust"—is included in Classification No. 1, of General Imports Order No. M-63.

In July 1942, flake graphite (cryst.), 90%, 325 mesh, 50% graphite carbon, in bags, carload lots at works, was priced at 7¢ per pound; 65% graphite was priced at 2½¢ and the 80% variety at 3½¢. The barrel price was generally ¼¢ per pound higher and the less-than-carload prices ran ½ to 1¢ higher.

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Gravel

SMOOTH, rounded stones or pebbles—above the mesh of sand fall into the category of the commercial gravel. The grains usually run above ¼th inch in diameter but may be as large as 3 inches. It may also contain pieces of shale, sandstone or other rock materials. Companies handling gravel wash and screen it to desired size and, where necessary, remove any clay or other organic matter.

Production is widespread throughout the United States but the principal producing states are New York, California, Illinois, Ohio, Michigan and Pennsylvania.

Statistics for 1941 show 96,385,957 short tons of gravel sold or used by commercial operators and 88,494,000 tons of government-and-contractor gravel also reported, the latter being produced by states, counties, municipalities, etc.

Principal use was in paving. Government-and-contractor use for roads totaled 79,715,000 tons and an additional 38,310,304 tons were reported sold for that purpose by commercial producers. For building, 37,900,243 tons were reported sold or used by commercial producers and 5,789,000 tons by the Government-and-contractor classification. Railroad ballast use was put at 16,302,175 tons and "other" uses were but 3,873,285 tons.

In 1941, paving gravel averaged 64¢ per ton while ballast was quoted at 33¢. Building gravel was 71¢ against 65¢ in 1940. Government-and-contractor materials — the classification used by the Government which was formerly called "noncommercial"—were priced at 43¢ per ton for building gravel and 29¢ for paving gravel.

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Grits (brewers)

See Hominy

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Groundwood Pulp

See Paper

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Guayule

GUAYULE is a dwarf deciduous shrub, native to the plateaus of north central Mexico. It grows about two feet high and in appearance much resembles the sage brush of our western plains. It matures in seven years and its growth for the last four years is very slight.

It is grown in areas where there is a winter rainfall from 10 to 15 inches, a long dry spell during the summer months during which time the rubber is formed in the cells

of the plant, and where the temperature does not drop below 5° F. in the winter. All parts of the plant except the foliage—including the roots—contain rubber. Principle source of supply in this country so far is in the Salinas Valley in California, although experimental plantings have been made in 115 various locations in California, Arizona, New Mexico and Texas.

The annual production in the United States up to date has been infinitesimal because the development has been purely on an experimental basis—this is due to the fact that the cost of producing in the past has been about 20¢ a pound, which is a much higher price than we had been compelled to pay for tree rubber from the Far East.

World production has been only about 7,500 tons a year and this has been limited entirely to Mexico. In 1942, however, the Mexican production was expected to reach 15,000 tons. American production will not begin until 1943 due to a seed shortage and our entire efforts are now being directed toward increasing the seed supply for future use. First large scale production of guayule in this country will be in 1944.

In the past the rubber industry has used guayule for various products in which adhesive qualities were needed. It has been used in tires with good results and gives about 90 per cent of the mileage obtained from tires made of tree rubber. Used with synthetic rubber, it will make an ideal tire because it has the adhesive qualities which synthetic rubbers lack.

The marketing unit in the past has been the pound or ton. In the future, with expanded production, the marketing unit will probably be limited to the ton. Prices are quoted by the pound. The market price of standard grade guayule in June, 1942, was 26¢ a pound compared with 17¢ a year before. There was no need for a government ceiling price because the entire output of rubber, whether tree, guayule, or synthetic is controlled by the Rubber Reserve Corporation.

The general method of transportation from producer to processor has been by boat and rail in wooden crates, 200 pounds per crate. If properly stored, guayule rubber will maintain its quality for several years.

There are only two different grades now being used. One is deresinated, which is a purer type of rubber, and the other underesinated. The difference in price is the cost of deresination which is, under current practices, about 7¢ a pound. Most of the guayule now being used is used in the underesinated state and mixed with the other rubber in the manufacture of tires. Unless Hevea rubber could be regarded as a substitute—it is now unavailable in the world markets—there is no other substitute for guayule rubber although synthetics may be used for some purposes for which guayule is used.

The war has stimulated the development of guayule and through the campaign waged by William O'Neil, president of The General Tire and Rubber Company, the government has taken over all guayule production and is expanding it as rapidly as the seed supply will permit. The war has necessarily increased the demand for guayule rubber.

In a general news release on the rubber situation, dated May 22, 1942, the Office For Emergency Management, had the following to say about guayule:

"The wild guayule shrub has been producing rubber for years in Mexico, and a small amount of cultivated guayule has been growing in the United States.

"A recent Act of Congress provided for the planting of 75,000 acres of guayule in the Western Hemisphere. Pursuant to this Act, all available guayule seeds in the United States have been planted, and from these seedlings will come not only a harvest of rubber-bearing shrubs, but more seeds to increase the plantings. However, it will take four to six years to grow enough guayule

rubber to make an appreciable contribution to the supply.

"Not more than 10,000 tons annually can be expected soon from Mexican guayule."

* * *

Gum Arabic

GUM arabic is a semi-wild product, the exudation of the tree Acacia Vrek. This gum tree grows only during the light rains between May and October of each year and the gum is formed beneath the bark to keep the tree moist and alive throughout the dry season. About 8,000 tons per year are produced, mostly in the Anglo-Egyptian Sudan.

Principal use is as emulsifying agent for oil emulsions but it is also used as an adhesive. It is marketed in the United States under U.S.P. specifications. The marketing unit for Crude and Grain is a bag of 220 pounds; in powdered form, it is shipped in barrels of 300 pounds. May, 1942, prices were: 20¢ per pound for Crude; 22¢ for Grain and 24¢ for Powdered. It maintains merchantable quality indefinitely if kept in a dry state. The crude is sold as Cleaned Amber Sorts. Grain is marketed cracked and sifted while the powder is approximately 150 mesh. No substitutes are known. There is a U. S. import duty of ½ per pound.

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Gum Camphor

See Camphor

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Gum Tragacanth

GUM TRAGACANTH is the dried, gummy exudation from various plants of the Astragulas Gummifor (Fam Leguminosae) and comes chiefly from Iran, Turkey and Syria. The plants grow wild in the mountainous regions and range from a foot to three feet high. It is a rock plant requiring little moisture. Natives tap the stem and return in about a week to collect the exudation. The gum has enormous swelling power in water which makes its use advantageous in many ways. Two types are usually exported to the United States, "Alleppo or Ribbon Type" and the "Persian or Flake Type." Alleppo types range from long blue white ribbons to dark cream flakes tinged with red or pink, while the Persian type ranges from creamy thin flakes to heavy dark brown ones. Turkey's product ranged from creamy white to dark brown in thin flakes, but this type has not been extensively imported into the U. S. for a number of years. The United States imports about 3 million pounds annually. Principal uses are in the textile industry, as a chemical emulsifier, in pharmaceuticals, cosmetics and in the food industry. The Aleppo type is usually imported, packed in cases of 200 to 300 pounds net while Persian comes in bags of 140 to 170 pounds net. It is marketed by the pound in original packages, or processed in powdered or cracked form and sold in barrels of 300 pounds net. Naturally the war disrupted imports and disturbed the price by reason of higher freight and marine insurance costs.

* * *

Gypsum

GYPSUM is a common mineral, hydrated calcium sulphate, $CaSO_4 \, 2H_2O$. In 1940, it was obtained—in crude form—from 15 states. Operations were reported at 28 underground mines, 26 open quarries and 5 combinations of mine and quarry. Total output was 2,699,015 short tons with New York the leading producer, followed by Michigan, Iowa and Texas. In addition, imports in 1940 totaled 1,405,210 tons of crude (including anhydrite) of which 1,368,194 tons were from Canada (Nova Scotia and New Brunswick).

In 1940, 3,704,110 tons of gypsum prod-

ucts were made from domestic, imported and byproduct crude gypsum, valued at $53,492,-644. Sales of uncalcined gypsum totaled 929,119 tons valued at $2,250,857. Of this total, 820,828 tons were for use as a portland-cement retarder and 92,232 tons were agricultural gypsum utilized mostly in the peanut area of the Southeast. For building use, 3,580,467 tons of calcined gypsum were sold while "industrial" users took 123,643 tons. Calcined gypsum was produced in 25 states by 55 plants.

Base-coat plasters, in the "building" group, made up 1,475,033 tons of the total; gauging and moulding plasters, 163,650 tons; lath, 1,072,555 tons; wallboard, 380,125 tons; sheathing board, 86,945 tons; and tile, 178,-315 tons. In the "industrial" classification, 40,741 tons were sold to plate-glass and terra-cotta works; 20,138 tons to pottery works; and 9,787 tons for orthopedic and dental plasters. It must be noted that sales of gypsum sheathing board, in 1940, jumped to 89½ million square feet from 5½ million in 1939.

Gypsum, for sheathing, competes with wood on a price basis and a rapidly increased demand resulted from the war demands for cantonments, etc.

The United States has been the principal producer of gypsum for some years. France, with late statistics missing, was the second largest producer (1,320,400 tons in 1937); Canada in third place with 1,314,311 tons in 1940, while the United Kingdom, in 1938, produced 1,109,928 tons.

Keene's cement (gypsum) in paper-bags on a carload basis was priced at $22.65 per ton, freight equald, Acme, Texas and $28.25 Harlem River, N. Y. Plaster of Paris, paper bags, was quoted at $12.50 per ton Harlem River, N. Y. while stucco in carload lots, paper bags, with freight equald, was priced at $8.00 per ton.

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Haddock

THE HADDOCK is the most important fish of the New England area, both in volume of production and actual value. The great bulk of this species is caught and landed in New England, as shown by the figures for 1940 when 141,193,000 pounds were landed with a value of $4,601,000. Only 7,743,000 pounds with a value of $323,000 were landed in the Middle Atlantic area and 12,000 pounds in the Chesapeake area.

A good example of the average monthly catches and an indication of the importance of the various ports can be seen from figures for April, 1942. In Boston there were 8,938,-760 pounds of large haddock landed with a value of $468,497 and 6,156,775 pounds of scrod haddock with a value of $286,775. (Scrod haddock is the small baby haddock.)

In Gloucester there were 1,228,857 pounds of large haddock with a value of $57,224 and 656,499 pounds of scrod with a value of $27,818.

In Portland, Maine, 452,625 pounds of large haddock were landed with a value of $27,318 and 193,920 pounds of scrod with a value of $10,064.

This makes a total monthly catch for April, 1942 of 10,620,242 pounds of large haddock with a value of $553,039 and 7,-007,194 pounds of scrod with a value of $324,025.

Haddock carries the Latin name of Melanogrammus aeglifinnus (Linnaeus). It has three separate fins on the back and two under the tail, and it also has a short whisker at the tip of the lower jaw. It differs from the cod in having a black lateral line (a pale line on the cod) along the side and a black blotch at the shoulder; in having the first fin on the back proportionately much higher and more pointed, and also higher than the other two fins, and in having a more deeply concave caudal fin.

The haddock, as seen in the markets, is

pale gray. When fresh from the water, the upper parts are dark purplish gray, becoming silvery gray with pinkish reflections below.

Haddock swim along the bottoms, ranging in depths from five downward to 100 fathoms. Principal catches are made in depths of 25 to 40 fathoms.

The bulk of the catches have been caught in the large otter trawls of the trawlers and bigger draggers. Smaller draggers account for large catches also. A goodly share is turned in by the traps and pound nets and a few by the gill nets. Large catches have been made by the line trawlers (dory fishermen).

Haddock are very prolific, a large female produces as many as 1,839,581 eggs at one spawning.

The introduction of filleting opened up a tremendous market for haddock and quick freezing and packaging increased it still more. During 1940 there were 37,130,766 pounds of fresh and frozen packaged haddock with a value of $4,521,226. Of this amount 16,379,263 pounds were fresh fillets and 20,610,503 pounds were frozen fillets.

Haddock are marketed in several ways; in the round, fresh and frozen; dressed and as fillets, both fresh and frozen; and as smoked, split and filleted.

Haddock are landed at the various fishing ports of Boston, Gloucester, and Portland, Maine, direct from the trawlers and draggers. They are immediately taken to the plants located close by where they are either filleted and packaged or shipped in the round, to markets all over the United States. Trucks and express handle these shipments.

In the smaller fishing ports, the boats land the fish at the docks where they are shipped by truck mostly, iced, in barrels and boxes to the large fishing ports and are there prepared for market. Haddock are always gutted on board ship. The livers are important for their oil content.

Government standards for haddock are: large, over 2½ pounds; scrod, 1½ to 2½ inclusive. Haddock is produced the year round.

Both haddock and cod are canned as fish flakes, fish balls, fish cakes and as fish chowder.

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Halibut Liver Oil

See Fish Liver Oils

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Hair (Cow)

It takes from ten to eleven average cattle tails to produce one pound of finished hair. Tail hair is clipped or pulled from slaughtered animals—washed and classified to color. Body hair is removed from hides by liming and ear hair is clipped from cured ears of slaughtered animals. The switches produced by United States packing houses constitute the principal source of tail hair although some is imported from South America and India. Body hair used here comes from domestic tanneries. Ear hair has hitherto been imported from South America almost exclusively but this country is now attempting to produce domestically.

Tail hair is used in upholstery, filters, cushions, mattresses, etc. Body hair is utilized by makers of felt and rug cushions and ear hair is made into brushes. In early May, 1942, Domestic Tail hair was quoted at 45¢ per lb., Chicago, compared with 33¢ a year previous. The ceiling price of 45¢ f.o.b., producing point, went into effect on Aug. 25, 1941. Transportation is in bales by boat, rail or truck. Cow hair is non-perishable, but like other animal hair, tends to get brittle with age. Principal tail hair grades are Frigorifico S.A. Classified, Campo S.A. All Grey, and Domestic Classified.

Substitutes for upholstery hair are cotton, moss, down, feathers, and fibres of various

kinds. There are no duties or excise taxes. The war has interfered with imports from Russia and South America.

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Hair (Hog)

To produce 100 lbs. of clean, processed hog body hair, requires the hair from 135 hogs in winter and from 200 hogs in summer. This hair is removed from the animals by dehairing machines in domestic packing houses. Principal industrial uses are in upholstery insulation, rug cushions and brush bristles.

The price in May 1942, was the ceiling of 8¢ F.O.B., producing point, which had prevailed since Aug. 25, 1941. This compared with 7½ cents, Chicago, in May, 1941. Shipping is in bales by rail and truck. Principal types are Grey Winter, Black Winter, Grey Summer and Black Summer.

Considerable body hair has been shipped to England on lend-lease. Partial results of the War were to curtail imports of bristles from Poland and China and place them on the list of strategic materials covered by W.P.B. Order M-63.

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Hair (Horse)

One average horse tail will make one pound of finished hair. Horse hair is also derived from the mane. In both instances it is clipped from Live or Slaughtered or Fallen animals; in the latter two cases it is washed and then classified to color—white, black or gray. Principal source of production is the Argentine and we also import from Mexico and Canada. Most important domestic producing areas are Texas and Montana. Before the War, Russia was an important source.

Principal uses are for upholstery, dressing, cushions, oil filters, mattresses and brushes. The marketing unit and price quotations are per lb. Early in May, 1942, tails were quoted at 70¢ per lb., New York, compared with 38¢ a year previous. Manes (South American Curled Hair) was selling at 50¢ per lb., New York, compared with the previous year's 20¢. There was no existing ceiling price.

This product is shipped in bales by boat and rail. Horse hair, like that of cows and hogs, is non-perishable although it does tend to get brittle with age. Principal type classifications of the curled hair industry are (for tails) Short Loose Classified and Short Tail Combings and (for manes) Loose Classified and Mane Combings. For upholstery hair, substitutes are cotton, moss, down, feathers and fibres of various kinds. There are no duties or excise taxes on imported hair.

The war diverted a large percentage of the hair domestically produced and imported to the war program. Horse hair was placed on the list of strategic materials covered by W.P.B. Order M-63. The military uses include seats and pads for army trucks, jeeps, airplanes, parachutes, boats, etc. The war seriously curtailed imports from Russia and South America.

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Hardwoods

Oak cut for lumber in the United States leads all other hardwoods in volume, representing more than one-third of the hardwood produced. In 1940, 1,467,386 thousand board feet of oak were produced for lumber in the United States against a total cut of 4,031,194 thousand feet of hardwood. Virginia was the leading contributor of oak lumber, followed closely by Arkansas, Louisiana, North Carolina, Tennessee and West Virginia. Almost the entire oak cut was in the eastern states: 435,597 thousand feet in the lower Mississippi area, 428,563 in Central States and 313,494 in the South Atlantic. Middle Atlantic States accounted for 97,875 thousand feet of the cut, Lake states for 84,270, and East Gulf for 89,296.

The sapwood of the American white oak is white while the heartwood is brown. The grain is coarse and the specific gravity when kiln-dried about 0.70. The compressive strength perpendicular to the grain is 1,870 pounds per square inch, exceeding that of softwoods such as Southern pine while the shearing strength parallel to the grain is about 1,300 pounds per inch or about the same as dried Southern pine.

Oak is hard, tough and durable wood and is used for flooring, cask staves, furniture, etc. Quartered oak, used for cabinet work, is the result of sawing at angles which produce beautiful graining effects. Fumed oak is oak given a "weathered-looking" finish through exposure to fumes of ammonia.

By Price Schedule No. 97, effective Feb. 6, 1942—the OPA brought oak lumber under maximum price schedules. It was explained that "southern hardwood lumber is an industrial wood extensively used in the manufacture of furniture, automobile trucks, containers, radio cabinets, agricultural implements, and farm and household utensils."

The war effort and the accompanying expanded economic demand increased the demand for certain species and grades of southern hardwood lumber beyond the readily available demand and necessitated the stabilization of prices.

Maximum prices were established for various grades and types of lumber. White oak, plain; White oak, quartered; Red oak, plain and quartered; and Red gum plain and quartered were brought under the price schedule. Sap gum, Tupelo, Black gum, Yellow poplar, Sycamore, Beech, Magnolia, Soft Maple, Soft Elm, Basswood, Cottonwood, Hackberry, Willow, Hickory, Ash (other than tough white ash), were other woods for which price ceilings was fixed. There were also prices named for tough white ash and for "box boards", "strips", and figured wood.

Lumber cut in the United States in 1940 from the hardwoods mentioned above, of a total hardwood cut of 4,031,194 thousand board feet, was: Ash, 84,211; Basswood, 99,857; Beech, 122,519; Cottonwood, 153,562; Elm, 92,096; Hickory, 35,289; Magnolia, 25,955; Maple, 462,947; Red Gum, 479,118; Sycamore, 31,591; Tupelo, 228,286; and Yellow Poplar 376,037 thousand board feet.

Whereas Price Schedule No. 97 covered southern hardwood lumber and lumber produced in the Kentucky and Tennessee portions of the Central hardwood area, it was considered necessary to create a separate regulation for hardwood lumber of the Central hardwoods area and Price Schedule No. 155 was made effective by OPA on June 1, 1942. Such hardwoods as Buckeye, Butternut and Hard Maple were included as well as the list of hardwoods embraced by Price Schedule No. 97.

Maximum price regulation No. 146, made effective May 19, 1942 covered Appalachian hardwood lumber. This price schedule covered such hardwoods as Tough Ash, Basswood, Beech, Birch, Buckeye, Butternut, Cherry, Hickory, Soft and Hard Maple, Red and White Oak and Yellow Poplar.

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Hay

HAY is composed of grasses which have been cured, often mixed with clover, and used as feed for horses and cattle. Numerous types of grass are grown for hay but here we discuss only the most important that are produced in the U. S.

The leading types of hay are timothy, clover and alfalfa. In addition, numerous types of grains are cut green for hay. Portions of other crops such as cowpeas, peanuts and soybeans are also cut for hay. Wild hay is grass which is allowed to grow wild and is harvested as hay.

During the growing season, ample supplies of moisture are needed. On the other hand,

dry weather is required at harvest time. The grass must be cut at a time when it contains a large quantity of nutritive ingredients and cured in such a way as to retain this matter.

U. S. production of all hay in 1941 amounted to 94.1 million tons. Minnesota is the leading producing state of the Union followed by Wisconsin, Iowa, California and New York.

Hay is one of the important feed crops of the nation. It constitutes one of the chief raw materials in the dairy and livestock industries. Indirectly, it affects the use of feed grains such as corn, oats and barley since they are interchangeable to a certain extent.

The marketing unit is the ton. Average prices received by farmers in March 1942, amounted to $11.03 per loose ton of all hay. Alfalfa hay averaged $12.99 per ton, clover and timothy mixed $13.58 per ton and prairie, $5.70 per ton. Transportation is by rail and truck. The duty on hay is $5 a ton and $2.50 per ton on hay imported from Canada.

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Heart (meat)

See Liver

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Helium

A COLORLESS, odorless, inert gas, helium (He) is, next to hydrogen, the lightest of the gases (specific gravity 0.138). It is twice as heavy as hydrogen, yet has a lifting power of 92 percent of that of gas. Its loss from diffusion is less rapid, and it will conduct heat at six times the conductivity of air.

Since the Civil War, when helium was discovered in the sun's spectrum, the gas has advanced to a point where it has entered the life of man in an important fashion. It occurs in certain minerals, mineral waters and natural gases (and in minute quantities in the air).

Production of helium in the United States for military use was initiated during the World War. In 1925, a plant was constructed with Army-Navy funds at Fort Worth, Texas and was placed in operation under control of the Bureau of Mines. This plant was closed in Jan., 1929 and another plant was put into operation at Amarillo, Texas, supplied with helium-bearing natural gas from the Cliffside gas fields—the gas rights of which were purchased by the U. S. government.

The helium produced at Amarillo is about 98.2 percent pure, the impurity being largely nitrogen. Under regulations the term "contained helium" is used to designate the quantity of helium in a mixture of that element and other gases. By an Act of Congress approved Sept. 1,1937, the Bureau of Mines was authorized to sell helium not needed for Government use. Until then, the gas in small quantities was priced at about $150 per thousand cubic feet. The government sells helium at a price slightly above cost.

During the year of 1940, about 10 million cubic feet of helium were produced at the Amarillo plant while, during the first half of 1941, 6,822,000 cubic feet were produced. It is estimated that the U. S. Government through 1940 had been responsible for the production of over 150 million cubic feet or 90 percent of all helium produced in the world.

In 1940, sales of residue natural gas, from which the helium had been extracted, totaled about 500 million cubic feet. The increased demand for helium, with the war, has prompted the sinking of new wells and installation of new helium production units.

The Navy continues to buy the bulk of the helium produced—for lighter-than-air craft, for use in observation and meteorological balloons, for diving operations and for other purposes. The Weather Bureau in 1940 received 2,624,355 cubic feet for use in inflating meteorological balloons — nearly three

times the use in 1939. The Army, too, utilizes helium in balloons. And, in the fiscal year of 1940, sales of helium for medical, scientific and commercial use totaled 1,514,-155 cubic feet, or 16 percent of plant output. More than 400,000 cubic feet of helium was employed for medical purposes, estimated as enough to provide 34,000 hours of treatment. Helium, usually mixed with about 20 percent oxygen, has been found to afford relief for asthma, to afford protection to compressed air workers from Diver's Disease or "Bends," and experiments have been conducted dealing with its use for diluting anesthetics to prevent fires and explosions.

The cost of producing helium varies with the output. In 1940, helium for commercial use was sold at $13.14 per thousand cubic feet against $15.088 (1938); for scientific use at $11.73 vs. $13.471; for medical use at $11.17 against $13.471 (1938); and as requisitioned by Government agencies, at $8.43 against $11.16 in 1938.

Natural gas samples are being continually tested for helium and detailed studies made of the characteristics of gases with a promising helium content and the Bureau of Mines plans to establish other helium-production plants whenever they are needed to meet the requirements of the war.

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Hemlock

See Spruce

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Hemp

See Manila Hemp

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Henequen and Sisal

THESE are two fibers commonly known in the markets of the world by the name of "sisal." They are obtained by scraping off, then washing and drying the fibrous portion of the broad leaves of two distinct species of the agave plant. Agave sisalana is the source of true sisal, while agave fourcroydes yields henequen. Both species originated in Yucatan and all production elsewhere is believed to have resulted from introduced plantings. True sisal and henequen usually differ in appearance and condition when entering commerce. True sisal is usually more carefully prepared than henequen. Over a hundred years ago, the hard fibers—abaca, sisal and henequen became cheaper for rope making and displaced hemp and flax. While abaca is employed where high tensile strength is required, sisal is used chiefly in the manufacture of wrapping twines and small ropes; henequen's principal use is as a binder twine. In recent years, henequen has had a greater use as a filling material in upholstered furniture. Short fibers, flume waste, "tow" and "bagasse" used in upholstering are estimated to equal from 10 to 20 per cent of total use. While sisal and henequen fibers are not as long or strong as Manila hemp, they are preferred as a binder twine, sometimes mixed with Manila hemp.

Henequen is produced mostly in Mexico with a small supply coming from Cuba and El Salvador. True sisal is produced in Java, Sumatra, Tanganyika, Kenya, Uganda, Angola, Portuguese East Africa, West Africa and Haiti. In 1938, world production of henequen and sisal combined amounted to approximately 400,000 tons. In 1940, United States imports of henequen and sisal totaled 141,471 long tons compared with 118,761 tons in 1939—or nearly three times as great as tonnage imports of Manila or abaca fiber.

Normally, we take 80 percent of Mexico's exports, almost all of Cuba's shipments, and virtually all of the product leaving Haiti.

In 1940, the United States imported 50,-000 tons from Mexico, 52,000 tons from the Netherlands East Indies, 18,000 tons from

Br. East Africa, 11,000 tons from Cuba and 8,000 tons from Haiti.

Henequen and sisal are normally sold by the long ton, ex dock point of import but priced by the hundred pounds. The war with its interruption of shipments from the Far East has naturally created a nominal price situation. In mid-1942, Mexican henequen was quoted at about 9¢ per pound f.o.b. New Orleans. In normal times Cuban and Mexican henequen sell at the same price, about ¼ to ½¢ per pound under African sisal. Haitian sisal usually commands a premium over the African variety and "true" sisal from Java a slight premium over that from Haiti.

The War Production Board, recognizing the uncertainty of future shipments of Agava fiber from abroad and national requirements for Agava cordage and twine, by order M-84 made effective Feb. 20, 1942—prohibited the acceptance of delivery unless specifically authorized by the Director of Industry Operations, with certain exceptions including deliveries by and to the Defense Supplies Corporation. Processing, purchases and sales were also brought under the order, and control taken of the stocks of the fiber.

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Herring

See Sardines

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Hexuronic Acid

See Ascorbic Acid

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Hickory

See Hardwoods

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Hides

See Cattlehides

Hogs

Bred and raised for their meat, hogs eat food of all kinds indiscriminately and their weight can be increased rapidly. The principal food, however, is corn and commercial production of hogs is influenced in large measure by the availability of that grain.

The United States leads the occidental world in hog production. Germany is next followed by Russia. Hogs are widely distributed throughout the European countries and are a particularly important meat-source in Poland, France and Denmark. They are also raised in great numbers in China, where official estimates in 1933 placed the total population at 94.6 million head. Hogs thrive best in temperate climates; thus warm countries have few of them. Depending on abundant grain or other fattening feeds also limits their commercial production.

Hogs are raised in every state in the United States, but chiefly in twelve north central states, which have more than 60 percent of the total hog population. These states have a moderate climate and an abundance of feed grains. Iowa leads in production, followed by Illinois, Indiana, Nebraska, Minnesota, Ohio and Missouri.

Our most concentrated hog population is in the most concentrated corn growing area. Abundant corn in the Central states has not only made profitable the production of hogs, but has also largely determined the type of hog grown. These hogs are heavy animals producing large quantities of fat. In other countries, where fattening grains are not so abundant, leaner hogs with long deep sides have been given preference. These are referred to as Bacon Type Hogs.

There is a distinct seasonal trend in the marketing of hogs. After the corn has matured in the fall and pastures have been killed by frost, farmers begin their active

feeding and fattening period. Hog receipts begin to increase in October and continue heavy into January (with rather sharp declines during Thanksgiving and Christmas weeks). In late January the receipts normally begin to decline and continue downward until about April, when they again increase. This latter increase is usually referred to as the "spring run." Fall and winter marketings are made up mostly of hogs born the previous spring while the spring run of hogs is made up largely of fall-born pigs. In late summer there are frequently a few weeks of heavy marketings with very heavy weights. These marketings contain a large percentage of discarded breeding stock, and in seasons when the corn supply is seriously threatened this run assumes considerable proportions.

Since the fall and winter marketings are made up largely of hogs from six months to one year of age they tend to have a lower average weight than the late summer run, which is composed of aged sows.

The rate of hog slaughter naturally influences the amount of pork products going into cold storage. Since the bulk of hogs are marketed and slaughtered in the fall and winter months the packer is called upon not only to process these products but to store them until consumer demand exceeds current supply. Packers' cold storage holdings of lard and pork products are lowest about December 1st. From there on, lard inventory rises steadily into August while pork products increase to March 1st and then usually decline slowly through the summer months. The annual slaughter in the United States ranges from about 50 to 75 million hogs.

The principal uses for hogs are for ultimate production of fats and meats. The rendered fat, known as lard, is used mainly for edible purposes although it finds its way into the production of soap when the price is unusually low. Meat products include pork, ham, bacon, sausages, chops, etc. Hogs are sold by the hundred weight. They are graded prime, choice, good, medium, common and cull. Hogs are also classified as butcher and bacon, depending on whether the animal is a lard type or bacon type hog. Transportation is by truck and rail.

Substitutes for hog products include other animal and vegetable oils for lard and other animal meats for hog meat.

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Hominy

HOMINY is a parched corn ground small. It is a dry maize product made by removing the hull and breaking the kernels into particles of even size, coarser than in corn meal.

It is purchased in original form by the bushel, and after processing, the trading unit is the pound. In bulk, grits are packed in 100-lb. bags, with flaked hominy packed in 50-lb. bags. Prior to the tin conservation order which halted hominy canning, considerable quantities were packed in this fashion, with Indiana, Illinois, and Iowa the principal producing states. It was packed the year 'round. In 1939, the latest year for which data are available, the pack of canned hominy totaled 1,911,811 cases, valued at $2,324,675.

Hominy finds its greatest distribution in the South, where it is used commonly as a breakfast cereal, and is also served in cooked form as a vegetable. Grits are also used by the brewing industry as an ingredient in beer.

Hominy, other than the canned, is very susceptible to weevil infestation and requires cool storage. It may be shipped by any of the usual forms of common carrier.

July, 1942, quotations for bulk hominy were $2.30 per 100 pounds for grits and $3.40 per 100 pounds for flakes, f.o.b. mills.

There is no import duty on hominy, save

hominy feed, which is dutiable at 10 per cent.

No price ceilings apply on hominy in lots in excess of 3 pounds.

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Honey

HONEY is the sweet, viscid fluid collected from the nectaries of flowers and elaborated for food by the honey bee. It is gathered by bees wherever there are blooms (flowers, fruit and vegetable). Bees in the hives (apiaries) are kept by professional beekeepers, although many farmers have a hive or two as part of their farming operation. The United States is the largest honey producer in the world, the 1941 crop being estimated at 206 million pounds. It is produced in every State of the Union, California leading with an output of about 26 million pounds. The sugar shortage and the loss of European markets have increased United States exports from Latin American countries. Foreign honey is not as carefully prepared, as a rule, being sometimes indifferently strained, thinner in body, strong in flavor and dark in color.

The most important use of honey is as a food and a sweetener in the home. It is used extensively for various manufacturing purposes such as bread and cake baking, confections, tobacco curing, alcoholic and non-alcoholic beverages, pharmaceuticals, cosmetics, and insecticides. The standard marketing container for honey is the 5-gallon can which contains 60 pounds. It is also packed in 50-gallon barrels or drums. Cans are shipped singly in fibre cartons or two to a wooden case. In May of 1942, the market was sold out and the price was roughly 15¢ per pound, or more than double that of the previous year.

Before the withdrawal of coastwise steamers, because of war shipping conditions, Pacific Coast honey came to the eastern seaboard by boat. Properly cured, honey will last indefinitely. Granulation occurs after a period but the original liquid condition can be restored by heating.

There is a different type of honey for every kind of blossom. Principal varieties in the United States are: white and sweet clover, alfalfa, white sage, sage buckwheat, buckwheat, orange blossom and tupelo. Some of the lesser known varieties include white catsclaw, mesquite, fireweed, palmetto, fall-flowers. While honey is identified by the variety it is also graded by colors. Official grades are water white, extra white, white, extra light amber, light amber, amber. Generally, the delicate flavored, light colored honeys command a higher price than the darker, stronger flavored varieties, the darker being used primarily for manufacturing purposes. Sugar syrups, corn syrups, invert syrups, etc. are substitutes for honey, but lack the same hygroscopic qualities. Honey assumed greater importance when the sugar shortage developed in 1942. The Department of Agriculture urged beekeepers to increase 1942 production by 50 million pounds (25%). Beekeeping also serves an important function in that it is extremely important in cross-pollenization.

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Hops

See Beer

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Horsehides

HORSEHIDES are used for making a wide variety of leathers, and while they represent a relatively limited proportion of the total amount of leather raw stock, they rank very high in the production of the leathers for which they are used.

A large part of the horsehides used in the United States are produced here, although hides are also imported from Europe in nor-

mal times as well as from Canada and the River Plate districts of Argentina and Brazil.

Horsehide leathers are made from the sides of both mature horses and colts and there is no trade distinction generally between the two.

One reason for the wide variety of leathers made from horsehides is the fact that the nature of the various parts of a horsehide are quite different, unlike most other types of raw stock. Glazed horsehide leather for garments and patent leather for shoes, handbags, etc., are made from horsehide sides. Cordovan, one of the most important types of horsehide leathers, is made from a prime portion of the butt, called the shell.

Other types of shoe upper leathers, glove leathers, clothing leathers, and special leathers for baseball gloves, mitts, and baseball covers, as well as leathers for razor strops, puttees, and some kinds of luggage are made from the fronts and shanks of horsehides.

Horsehide leathers are in strong demand at all times for making heavy glove and serviceable garment leathers.

To protect the supplies of horsehide leathers required for military use, the War Production Board in May, 1942 (Order No. M-141) took complete control of the entire supply and production of horsehide fronts suitable for gloves, jackets, windbreakers, and other military garments.

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Horseradish

HORSERADISH is a tall coarse white-flowered herb native to Europe, and widely cultivated in the middle western states. The same term is applied to a condiment made of the ground part of the horseradish plant, often moistened with vinegar.

For consumption in fresh form, horseradish is packed in baskets, of 3 to 5 pounds, and is sold on the basis of the pound. The price varies widely as to supply and quality.

Commercial processors purchase horseradish roots in barrels, generally of 400 pounds, or in bags. The product is bought on the basis of the pound, and is used for pickling and in manufacturing condiments. It is also processed in powdered form. It may be shipped by either rail or truck.

The condiment is packed in glass, generally in either 6-ounce containers or in one-gallon jars. July, 1942, values were 70 cents per dozen for the small size and 80 cents for the gallon container, this applying to competitive grades. Advertised brands carry a substantial premium over these figures.

Horseradish must be kept in a cool, dark place, and must not be exposed to light and air, as it loses its strength.

Import duty on horseradish is 3 cents per pound for crude, and 35 per cent on prepared or preserved horseradish.

Fresh horseradish does not come under the General Maximum Price Regulation; the processed product is under ceiling regulation.

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Hubnerite

See Tungsten

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Hydroxybenzene

See Phenol

★ ★ ★

Idaho Pine

See Ponderosa Pine

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Ilmenite

ILMENITE is a mineral, resembling in appearance jet black grains of sand. It is obtained principally from the sands along the beach and in the sand dunes of Travancore, India, and is also found in the earth where it is mined similarly to iron. In fact, it is closely

associated with iron and occasionally with mica. In India the natives gather the sand and carry it on their backs in baskets to the plant where it is passed over magnetic separators and the Ilmenite, which has certain mechanical characteristics, comes out almost 100% pure. In the process, other particles of sand such as monazite, zircon, silica, rutile, garnet, etc., have been removed.

In peace-time, India produces about 200,000 tons per year but, with the war, production was believed to have dropped to only about one-tenth of normal due to the lack of shipping space to the United States and Britain. As a compensating factor the U. S. Government encouraged production in the Adirondacks and in the mountains of North Carolina. It is hoped that domestic production will eventually reach close to 300/400,000 tons annually, but many in the trade think this estimate too optimistic. The American product runs about 45% TiO_2, as against 52/60% for that from India.

The principal use for Ilmenite is in the manufacture of Titanium pigments. These pigments are employed in making paints of high quality, their principal characteristics being extreme whiteness and great hiding power of the pigments. To a lesser extent Ilmenite enters the manufacture of enamels. It is marketed by the ton.

It is not perishable but wind loss can occur at stock piles unless the material is placed under cover or surfaced with some material such as asphalt. There are no actual substitutes for Ilmenite although in paints its competitive materials are zinc oxide and lithopone. There is no U. S. import duty, as it comes into this country as sand.

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Indium

INDIUM is a very soft, heavy (specific gravity 7.28) metal (In), silvery and easily melted (melting point 155°-C.), boiling at red heat. About twenty years ago it took several months to round up a total of one gram of the metal at a cost considerably higher than platinum—$10 per gram. Lately, sizeable quantities of indium-bearing ore were found in Mohave County, Arizona and the deposit was explored with shaft and drifts. However, the potentially large production of indium from metallurgical residues has more than sufficed for current needs.

In the last two years, the price of commercial indium (98+ percent) has dropped from $30 to $12.50 per troy ounce. Most of the indium has resulted from the extraction of it and sundry associated metals in connection with wet methods of extracting zinc. Complex waste muds from these processes are treated with hot dilute sulfuric acid and precipitated by treating the solution with zinc. The resulting sponge, which contains not only indium but also cadmium and a little lead, nickel, tin and copper, is filtered off and leached first with not quite enough hot dilute acid to dissolve the cadmium. Further leaching of the remaining sponge dissolves other metals, and after lead sulfate and other insoluble matter have been filtered out this second solution is treated with an excess of ammonia. This precipitates indium hydroxide, which can be separated, washed and ignited to trioxide. Metallic indium of 97 to 98.5 percent purity is made directly from this impure trioxide by an electrolytic method and can be further purified if required.

The lowered price for indium has increased the demand, especially for use in platings and diffused platings on cadmium and other alloy bearings for airplane and other high-duty internal combustion engines.

Indium too, after extensive tests, is being used in solders to replace the usual tin-lead solders, as well as in brazing alloys of copper-silver. In both instances the use of Indium materially improves the spreadability, coverage and bonding of the solders and brazing

alloys. This development, due to the tin situation, is of great interest. Indium is also used in small quantities as an alloy constituent for jewelry and dental alloys, to improve the tarnish resistance in silverware, and as a glass colorant (the oxide and sulphur compounds impart light-yellow to dark-yellow amber colors to glass and only 0.05 percent indium is necessary for a beautiful yellow product). The metal is also used in the electrical contact field and in low-melting alloys.

In dental castings 0.5 percent indium is said to improve corrosion resistance, melting range, hardness and strength. In wearing parts of engines and machines, indium affords desired corrosion resistance without impairing fatigue resistance and other good properties of cadmium copper and lead alloy bearings.

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Industrial Alcohol

See Alcohol

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Insect Wax

See Chinese Insect Wax

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Iodine

IODINE is encountered as purplish-black scales, volatizing slowly at room temperatures and rapidly at higher temperatures to produce a violet vapor. The crystals and vapor are poisonous and corrosive. The solid material is only slightly soluble in water, but readily soluble in the alkaline iodide solutions and in alcohol, ether, and similar solvents. The alcoholic solutions are identified as tinctures. Several are official in the United States Pharmacopeia and National Formulary.

One of the principal sources of iodine is the sodium iodate content of the mother liquor secured in refining Chilean saltpeter. The sodium iodate is reacted with sodium bisulphite, which precipitates the iodine. The crude iodine is then purified by sublimation to remove bromine, chlorine, and other impurities. A second source of iodine are the various forms of kelps and seaweeds. Such vegetation is boiled with soda ash, the alginic acid content precipitated with muriatic acid, then the filtrate is neutralized and evaporated to dryness to obtain crude sodium iodate.

Two plants in the United States, both located in California, produce iodine. The most recent output figures available are for 1937, when 299,286 pounds, valued at $242,422, were produced. Imports of crude iodine into the United States during 1940 amounted to 1,244,146 pounds, valued at $1,296,181. In 1939 imports totaled 200,000 pounds, valued at $168,238. Chile supplies the major portion of the world's iodine needs. France, the United Kingdom, Ireland, Norway, Japan, the Netherlands Indies, and India also produce commercial amounts of iodine.

Packages employed for iodine in commerce include kegs containing 200 and 100 pounds; cases containing two 50-pound jugs; jars ranging from 5 to 50 pounds in content; and bottles varying from $\frac{1}{4}$ to 5 pounds in content. It is offered in crude grade for technical application, and in resublimed grade meeting the requirements of the United States Pharmacopeia.

The chief use of iodine compounds industrially is in the manufacture of photographic emulsions. It is also employed in organic synthesis, in making certain dyes, and as a catalyst in intermediate manufacture. The resublimed material is used in medicine for its antiseptic qualities. Crude iodine in recent years has been priced at approximately $1.35 per pound, in large quantities. The resublimed material was quoted at $2.00 per pound during the first half of 1942; and at $1.75 per pound at the beginning of 1941.

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Iridium

ONE of the heaviest substances known, iridium (Ir) is a rare metallic element of the platinum group. Its specific gravity is 22.42, or by volume more than twenty times the weight of water. It is insoluble in all acids and in aqua regia. Like platinum and allied metals, it has a high melting point (4260° F.), is grayish-white, and resists oxidation up to about 700° C. and above 900° C.; between 700-900° C. a dark blue iridium oxide is formed on the surface of the metal. Iridium has a relatively high rate of volatilization above 1000° C.

It is found in a natural state together with the metal osmium, the ore being called osmiridium. Production and sales, like that of other less-platinum metals is very small, being counted in the ounces. Sales in the U. S. in 1940, combined with those of osmium, rhodium and ruthenium, totalled but 14,593 troy ounces, while imports of iridium in that year were but 237 ounces—all from the United Kingdom. Production of osmiridium by treatment of gold ores on the Rand (South Africa) amounted to 7,031 ounces in 1939.

The price of iridium jumped from $148 to $300 per ounce in late 1940 due to the increased demand from the aircraft industry and speculative influences but, following a statement from OPM in January 1941, the price was lowered to $175 per ounce in February. It is now about $165 to $175 nominal.

Iridium's use is mostly as a hardening addition to platinum, rendering it suitable for laboratory vessels, surgical tools, hypodermic needles, and jewelry. Its compounds are employed as fixing agents, porcelain pigment, and (in the form of black) as a catalyst. When used in jewelry, about 10 percent iridium is employed.

Currently, iridium supplies are being used almost entirely in the war program, chiefly in magneto points on airplanes. The War Production Board by Order M-49 made effective Dec. 12, 1941, among other things prohibited the use of the metal or its alloys in jewelry of any kind.

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Irish Whiskey

See Distilled Spirits

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Iron Ammonium Citrate

IRON AMMONIUM CITRATE is also known as ferric ammonium citrate, and is available commercially as brown or green granules, pearls, scales, and powder. The granular and pearl forms are most popular for industrial applications, the scales are more often used in medicine, and the powder is only occasionally encountered. The material is produced by reacting citric acid with ferric hydroxide, then adding ammonium hydroxide, followed by filtration. The exact chemical composition of ferric ammonium citrate is indefinite.

The United States production of iron ammonium citrate in 1939 amounted to 280,263 pounds, valued at $94,836. In 1937 the output was 340,863 pounds, valued at $108,-413. In both years four manufacturing plants were in operation. Commercially, the citrate is packed in 50 and 25-pound drums, and in 5 and one-pound bottles and cans.

Iron ammonium citrate finds its largest use as a sensitizing agent in the manufacture of blueprint papers. It is also employed in medicine as a method of administering iron. The price of the pearl and granular forms of iron ammonium citrate on June 1, 1942 and January 1, 1942 was 32¢ per pound. The scale material was quoted at 44¢ on the dates shown.

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Iron and Steel

THE steel industry of the United States is the largest producer of steel in the world. It is also the largest manufacturing industry in this country.

It employs approximately 650,000 men in 253 separate communities from the Atlantic Seaboard to the Pacific Coast. Its payroll in 1941 exceeded $1,280,000,000. At the beginning of 1942 the industry had a productive capacity of over 88,000,000 net tons of steel ingots and castings. That capacity is almost 45 percent greater than steel capacity at the end of 1918, and it represents approximately 50 percent of the world's total steel making capacity.

The industry is fortunately situated with regard to raw materials. Of the total tonnage of raw materials needed to manufacture steel at a capacity rate in this country, foreign sources of supply are required for less than one-half of one percent. The iron and steel companies can supply 75 percent of the tonnage of needed materials from their materials reserves, and can purchase from domestic sources all but a fraction of their remaining needs.

The principal raw materials needed in making iron are iron ore, coal and limestone. The United States is entirely self sufficient with regard to these three minerals. To sustain capacity operations approximately 100,000,000 tons of ore, 84,000,000 tons of coal and 26,000,000 tons of limestone are needed annually.

The bringing together of these raw materials of iron is a great transportation achievement. The better ores are mostly mined in the Northwest, principally Minnesota, chiefly from open pits. These run as much as 2½ miles long and 350 feet deep, with as many as 15 terraces dug by steam shovel into the sides. Electric shovels, with capacities up to 17 tons in one bite, load the ore into specially designed hopper cars. About 40% of the open pit ore goes to crushing and screening plants, where the larger chunks are reduced to the size for efficient blast furnace handling. The ores are washed, graded and shipped by rail to huge loading docks on Lake Superior and shipped by specially built lake boats during the open season.

The coal, chosen particularly for its coking and steam-making qualities, is mined largely in western Pennsylvania, West Virginia, Kentucky, southern Illinois, and Alabama. It is coked in special ovens which recover valuable by-products such as gas, benzol, toluol, ammonium sulphate, coal tar, etc.

Limestone, chief fluxing material for the blast furnace, is found in scattered mines and quarries and goes to the blast furnace by rail or water.

Before the ore cars leave the mines for the sorting yards the ore is sampled and analyzed for percentage of iron, phosphorus, silica and perhaps manganese. This later permits the blast furnace superintendent to order iron ore in large quantities by specification. Most of the rail run from the iron ranges to the lake is downgrade and single trains move as much as 13,000 tons, or a large lake boat cargo. The largest ore dock is 2,304 feet long and has a storage capacity of 153,600 gross tons.

The Birmingham area has ore and coking coal directly adjacent, minimizing transportation needs and making possible the lowest pig-iron production costs in the country.

Most American commercial iron ores are red hematites, composed chiefly of iron oxide with some impurities, chiefly silica. Only the best ores are used and reserves are ample.

The ore is smelted in blast furnaces, which are as high as 100 feet and produce as much as 1,000 tons of pig iron a day. Ore, coke and limestone in a proportion of

approximately twelve, six and three are dumped into the furnace from the top through a bell hopper. The molten iron, containing about 3.5 to 4% carbon, is poured or "tapped out" at the bottom and usually is run straight into huge ladles on tracks and pushed across the yard by a switching engine to a storage mixer. The huge mixer, which is located at the head of the open hearth mill (where the blast furnace iron is to be refined to steel) usually contains a reserve of several hundred tons. Smaller ladles will here obtain the molten iron that is to be charged into the open hearth furnace.

All of the molten iron is not destined for immediate use in the making of steel in the open hearth furnace. Ladles of this molten iron may also be taken from the blast furnace and poured into molds at the pigcasting machine. The castings obtained, commonly called "pigs," weigh from 50 to 100 lbs. each. After cooling, the "pigs" are ready to be marketed for use in iron foundries, or in the open hearth furnace, along with scrap, to make steel.

About as much scrap steel as pig iron is used in making steel. Part of the scrap originates in the steel mills themselves during various stages of manufacturing, while the rest is purchased from scrap dealers who collect it and divide it into various grades.

For the most widely used steel producing process, open hearth furnaces are employed. The material charged into these furnaces consists of blast furnace iron, steel scrap and frequently iron ore. The bottom of the open hearth is first covered with slag-making materials, such as limestone. The scrap charge is followed in two to three hours by the molten iron from the storage mixer, mentioned before.

Close observation is required during the melting process. Samples are taken during the progress of the heat for exact analysis in the chemical laboratory. Early in the heat of steel, ferrous oxide in the form of ore, is added to burn out part of the carbon in the metal. Excess oxygen is removed by addition of ferro-manganese toward the end of the heat. In addition to its function as a deoxidizing agent, it is also a source of manganese which is responsible for some of the hardening properties of steel.

Most steel today is refined in the open-hearth furnace, which permits greater control over the metallic bath than the older Bessemer process. The latter is faster and one of the most spectacular processes of modern industry, but it cannot be so easily regulated, and leaves some sulphur and phosphorus in the metal. Also the open hearth will take scrap steel, which, depending on the price comparison with pig iron, may amount to as much as 60% of the charge. The melter in charge of the open-hearth furnace, which takes a charge up of 100 tons or more to a heat, can take frequent chemical analyses of the metal being refined, and add as needed scrap, manganese, limestone, and so on.

After the "heat" of steel is "finished," which usually requires from ten to twelve hours, the finished metal is tapped off by gravity into a huge ladle slung from an overhead crane, which in turn is swung over the ingot molds and the molten steel is poured into them. These ingots, ordinarily ranging between ten and twenty tons are on flat-cars and when slightly cooled are run under a stripping crane where the molds are pulled off the still red but now solidified ingots.

After stripping, the ingots, still hot, are put in the "soaking pits" and soaked in burning gases which equalize outside and inside temperature.

The ingot is now moved to the approach table of the blooming mill to receive its preliminary reduction in dimensions. The top of the ingot, or the "pipe," contains impurities and has to be cut off. It is then

passed mechanically back and forth through a "reversing stand" and squeezed down with each pass, becoming longer and longer, and finally converted into a bloom, slab, or billet, as may be desired. Ingots are sometimes rolled directly into finished steel after the slab, billet or blooming mill gives them their first reduction, without being allowed to cool. Sometimes, however, the steel is merely rolled into one of these intermediate shapes and shipped to the finishing mill for reduction to the final shape, which is effected by continuing the process of passing the reheated steel through continuous or reversing mills.

Some rails, particularly those for passenger and high-speed rail tracks, are given special heat-treatment known as "Brunorizing" to refine the grain structure of the steel. Railends—the chief wearing point—are hardened under compressed air to forestall "end-batter."

Slabs are rolled from ingots and are the intermediate shape for processing into plates, sheets, and tinplate. Heated to exact temperature, the slab, weighing up to 5 tons, is passed through the first stand of roughing rolls where its surface scale is broken up and washed away by streams of water under 1,000 pounds pressure per square inch. It is then turned round and passed through a broadside mill which spreads its overall width when necessary. Next it passes to a squeezer which readjusts its width to order. It is then passed through a reversing roughing stand which thins it to requirement. It is then run down to the finishing stand which it runs through at 30 miles an hour to emerge on the runout table as a wide scarlet steel carpet of great length. The irregular ends are cropped, the plate cooled, cut to width by a rotary side shear and cut into finished lengths for shipment.

For hot strip, the hot plate is rolled further until it is about 400 feet long, then coiled hot. It is then passed through a pickling process to clean the surface for cold-reducing. To make black plate for tinning, the strip receives a further cold-reduction in a "temper" pass. The final reduction for tinplate extends the original slab out to a length of about $1\frac{1}{2}$ miles. It then goes through a flying shears at about 400 feet a minute, at which rate the shears cut it into proper length and automatically discard all sheets varying more than 1% from the standard weight, which is now about 1/100th of an inch in thickness. These tin plates are then white-pickled and sent to the tin pots for coating with tin. They are then sorted and inspected, and sent to the tin can factories.

Sheets to be galvanized, are first annealed, pickled and washed, then immersed in tanks of water containing a trace of acid to prevent oxidation of the surface, then passed through a bath of molten zinc, inspected, and stacked for shipment.

Sheet-coil for "auto sheets" undergoes cold-reduction under a pressure of two to three million pounds per square inch, emerging from the process and recoiling at the rate of some 1,500 feet a second. Cold-rolling develops additional strength and hardness. Thereafter the steel must be annealed, which in modern practice is done in ovens so large that the sheet has to be stacked and the oven, about the size of a cottage, lowered carefully over it by overhead crane.

More than thirty types of tubes and tubular products are turned out by one of three standard processes—welding, piercing, or cupping. Some classes of steel tubes are cold-drawn through dies, especially where close tolerances are required. Thus, stainless steel tubes are drawn for special uses in the chemical and food industries.

All wire products are drawn from rods which have been rolled from billets, which in turn were rolled from ingots. Reheated at the wire mill, the billets pass through a

series of rolls and are reduced in diameter with each pass. They emerge as bundles of rod which look like heavy wire. Rods and wires are drawn through dies of alloy steel, tungsten-carbide, or diamonds. In drawing wire, a tapered end is inserted into the die as a needle is threaded, and then attached to a winch-like tension block which provides the pull. The rod is pulled through a number of these dies in succession with intervening annealing treatments as required by processing or specifications, to the desired size. Not all wire is round; some is drawn square, rectangular, or to other shapes.

Conspicuous characteristic of iron and steel-making is the gargantuan nature of the operations. From the iron ore mine to the finished product, machinery has very largely replaced hard labor, and as far as possible human judgment has been augmented by highly developed measurements for heat, weight, hardness, ductility, malleability, tensile strength, and so forth.

Most steel prices were quoted, up to 1924, on the basis of the price at Pittsburgh, plus the freight from there. Thereafter, a large number of basing points were established, and in 1939 this system was further modified and decentralized, and the differentials in the basing point prices between Pittsburgh, Chicago and Birmingham eliminated for most products. Political pressure from Washington seems aimed at the establishment of f.o.b. mill prices, but this has been resisted by the trade as inconvenient and complicated.

The biggest year on record for the steel industry was 1941 when nearly 83,000,000 tons of steel were produced. Output in the first half of 1942 showed still further gain. To increase its capacity and to eliminate any potential bottlenecks in production, the steel industry and the government together were scheduled to spend $1,100,000,000 for new plants and equipment in 1941 and 1942.

Due to their importance in the war, iron and steel were placed under priority and price control.

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Isinglass

See Mica

★ ★ ★

Isobutylene

See Synthetic Rubber

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Isopropyl Alcohol

ISOPROPYL ALCOHOL is a colorless mobile liquid, having less odor than ethyl alcohol and a slightly higher boiling point. It is the next higher compound in the alcohol group. Isopropanol and secondary propyl alcohol are other names by which it is sometimes identified. The principal source of the material is from the cracking gases formed in the petroleum industry, and from natural gas. The propylene in the oil gas is treated with sulfuric acid to form propyl hydrogen sulfate, which upon the addition of water breaks down to form isopropyl alcohol.

Commercially, isopropyl alcohol is offered in a denaturing grade and in refined and technical grades of 91 and 98 per cent purity. Water is the principal impurity. Production of isopropyl alcohol in 1940 was 219,925,900 pounds; while in 1939 the output was 179,062,266 pounds. In addition to tankcars, the material is shipped in 110 and 55 gallon drums and smaller tins.

Isopropyl alcohol resembles ethyl alcohol in solvent properties and is therefore used as a substitute to avoid the legal restrictions of the latter product. It cannot, however, be used as a substitute in food products. The price of 91 per cent isopropyl alcohol on June 1, 1942 and January 1, 1942 was approximately 40¢ per gallon. On January 1,

1941 the 91 per cent grade was about 35¢ per gallon. The 99 per cent material on June 1 and January 1, 1942 was approximately 44¢ per gallon; while on January 1, 1941 it was quoted at 38¢ per gallon.

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Ispropanol

See Isopropyl Alcohol

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Istle Fibres

See Ixtle Fibres

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Ixtle Fibers

IXTLE fibers, substitutes for henequen and manila hemp, fall into two main groups. Ixtle de Palma, the more important commercially, is a species of yucca and resembles henequen in appearance althongh having a lower tensile strength. Ixtle de Lechuguilla, a small plant of the Agave family, is used as a substitute for horsehair or bristles in the manufacture of cheap brushes and, in a small degree, in rope, twine and coarse sacks.

The cultivation of Ixtle de Palma in Mexico has shown a steady increase during recent years. The 1942 crop, according to estimates, amounted to 20,000 metric tons compared with 17,227 tons in 1941 and 15,000 in 1940. The production of Ixtle de Lechuguilla is estimated at 11,000 metric tons for 1942, compared with about 8,000 to 9,000 in 1941 and 11,414 in 1940.

The War Production Board through Order M-84, covering the use and stocks of agave fibers, limits amounts used as binder twine and other uses.

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Jalap

JALAP is a purified resin obtained from the tuberous root of a Mexican plant. The process involves drying, percolation, precipitation and with further drying the resin is formed. It is produced by all drug manufacturers. Its principal use is as a cathartic in pills and tablets. It is marketed by the pound. The price in May, 1942, was quoted as $8.00 against a normal $3.25 quotation. It is usually shipped in fibre drums or in tins. With dry storage it will keep for years. Two principal types are lump and powder.

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Japan Tallow

See Japan Wax

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Japan Wax

JAPAN WAX, or Japan tallow is a white or pale yellow solid wax obtained from the berries of three varieties of sumac plants, *Rhus succedanea, Rhus vernicifera,* and *Rhus sylvestris*. To isolate the wax, the berries are ground to a meal, heated with steam, and then pressed. The fruit is also sometimes boiled with water and the molten wax collected from the top of the kettle. The wax is bleached by exposure to sunlight.

Imports of Japan wax in 1939 amounted to 3,645,175 pounds, valued at $363,103, all from Japan. In 1940, 2,328,131 pounds of the wax were imported, valued at $323,706. For shipment it is packed in wooden boxes. The price of Japan wax on June 1, 1942 was 40¢ per pound. At the beginning of 1942 it was 30¢ per pound, and at the start of 1941, 18¢ per pound.

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Jumbo Shrimps

See Shrimp

Juniper Oil

JUNIPER or juniperberry oil is a colorless to yellow oil, having a bitter taste produced by distilling the berries of the Juniper tree, Juniper communis, with steam. On exposure to air the oil darkens and assumes a turpentine-like odor. It is official in the United States Pharmacopeia. A juniperwood oil, of variable composition is also encountered in commerce. The latter material is sometimes a mixture of the berry oil and turpentine oil, or a turpentine oil which has been distilled in the presence of juniper wood or twigs.

In 1940, 2,842 pounds of juniper oil, valued at $5,249, were imported into the United States. Italy was the largest supplier, with 1,512 pounds; Yugoslavia ranked second, with 1,330 pounds. In 1939, 4,648 pounds were imported, valued at $5,024. In that year Italy and Yugoslavia again were the most important sources of supply, with 2,851 pounds and 1,036 pounds respectively. Commercially a technical and rectified grade of juniper oil is packed in 25-pound tins. A twice rectified material is packaged in five-pound bottles. Technical juniperwood oil is packed in 50-pound tins.

Juniper oil is used in medicine, in the manufacture of liqueurs, and as a flavoring material for gin. The juniperwood oil is used in veterinary medicine. Juniperberry oil on June 1, 1942 was priced at $12.00 per pound. On January 1, 1942, it was priced at $15.00; and at the beginning of 1941, $9.00 per pound. The price of juniperwood oil on June 1, 1942, was $1.50 per pound; while on January 1, 1942, this technical oil was in short supply so that quotations were on a nominal basis. In January, 1941, the wood oil was priced at 50¢ per pound.

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Jute

See Burlap

Jute Board

See Paper

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Kainite

See Alum

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Kaolin

See China Clay

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Kapok

KAPOK is a long, white silky fiber obtained from the silk-cotton tree, common to many tropical countries. The fibers, while much like cotton in appearance, are too brittle to be spun.

Most of United States imports have come from Java and the war has naturally disrupted shipments. While kapok has been used extensively for mattress and furniture stuffing, its lightness and resiliency has made it especially adaptable for fine padding work.

The uncertainty of future shipments caused the War Production Board by Order M-85, effective Feb. 4, 1942, to place restrictions on sales and deliveries. In defining "Kapok" the order included the "fiber or pulp from the pod of the Ceiba or Kapok tree, except that grown in South and Central America * * *".

Restrictions on production held manufacturers, unless specifically authorized, to the following products: (1) Life buoys to fill defense orders. (2) Life preservers, life jackets and collars to fill defense orders. (3) Sleeping bags, mattresses, pillows, blankets and pontoon bridges to fill orders placed by the War and Navy Departments * * *. (4) Insulation padding for airplanes, but only to the extent of 45% of the actual total fiber content of such insulation padding; provided however, that no person shall use any Kapok of Java grades for the production of such

product unless and until such person shall be unable to obtain any other kapok for such purposes * * *".

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Kelp

KELP is the dehydrated (or otherwise dried), ground seaweed, having the appearance of ground, roasted coffee. Macrocystis pyrifera is the species used mainly along the Pacific Coast. It is harvested from growth within 50 miles from shore along the coast of Southern California from Pt. Arguello to the U. S.-Mexican boundary and to a limited extent in Pacific Ocean waters along the entire coastline. Some kelp is also taken along the Eastern seaboard. About 40,000 to 50,000 tons are taken yearly off the coast of California. In normal times considerable amounts are imported from Japan, and some from Scandinavian countries. It is used as an organic mineral supplement for poultry and livestock feeds and for human dietary purposes. Marketing is in bulk by the ton, and also in packaged and tablet form. May, 1942, prices on a tonnage basis ranged from $50 to more than $100 per ton and the price on smaller packaged lots, while fairly stable, varied with the type. Kelp will keep indefinitely if protected from excess moisture. Mill run grades are used in animal feeds; selected grades for humans. Substitutes are inorganic mineral products. There is no U. S. import duty on the unprocessed product.

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Kerosene

KEROSENE is a refined petroleum distillate having a flash point not below 73° F. Most states and cities, however, have laws requiring flash points of 110° F. or higher. It is processed from crude petroleum at refineries throughout the United States. Production in 1941 was 72,586,000 barrels, equal to about 50% of world production. Its principal uses are as a range oil, for heating, illumination, incubation, and as a fuel for some types of farm tractors. The marketing unit is the gallon. Prices vary with the locality, type, etc. It is transported by tankers, tank cars, pipelines, tank trucks and as package freight. It will last almost indefinitely in tight storage with some change in color. Principal types are range oil, lamp oil, heating oil, tractor distillate. Coal oil, bottled gas, electricity, natural and manufactured gas, are naturally useable substitutes, as well as other commodities. The import duty is ½¢ per gallon.

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Kidney (meat)

See Liver

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Kidskins

KIDSKINS are the skins of young goats, and in commercial practice the term "kidskin" is applied to practically all goatskins and particularly to the leathers made from goatskins. Kidskins are smaller and usually finer grained than are the skins from mature goats, and therefore the leathers made from them are usually the lightest and finest of the goatskin group.

Kidskins are derived from the same general sources as the skins of mature goats, they are combined with goatskins in compiling production and foreign trade statistics, and they are subject to the same Government wartime regulations of production and price.

As a general rule, kidskins are used for making fine shoe upper leathers, glove leathers, handbag leathers, etc., while the heavier goatskins are used chiefly for slippers, shoe linings, garments, etc. This is not always true, however, because of the use of the term kidskin synonomously with that of goatskin in common trade practice.

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Kips

See Kipskins

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Kipskins

KIPSKINS are the skins of a medium sized animal of practically any species, but in trade usage the term in the United States is confined to designating the skins of bovine animals weighing in a green salted condition between 16 and 25 pounds, the classification falling between the trade classifications of calfskins and cattlehides.

Production and foreign trade statistics commonly group kipskins together with cattlehides or with calfskins in such a manner that it is difficult to separate them as a distinct group. In commercial practice, however, kipskins have a definite identity, as do the leathers for which they are used.

The price of kipskins was regulated by the Office of Price Administration in June, 1941 and the latest revision to the original price ceiling, which has an effect on kipskins, was issued in Oct., 1941. This sets the price for common grades at 20¢ per pound for packed unbranded kipskins; 17½¢ for unbranded packer skins; 18¢ for Chicago city kipskins; and 16¢ for country skins.

During 1940 the average price of all kipskins was 17.16¢ per pound.

All types and grades of kipskins are included in the War Production Board's allocation program for domestic cattlehides, and purchase permits are required.

Kipskins are obtained from the same sources as cattlehides and calfskins, both domestic and foreign.

The statistics on kipskin leathers are intermingled with those on calf and cattlehide leathers in a manner that makes separation difficult. Ordinarily, kip sides, large kipskins which are split along the backbone into two halves—are statistically classed with cattlehide sides, while the smaller kipskins, tanned whole, are grouped with calfskins.

Cattlehide and kip side leathers are similar, except that the kip leathers are the smaller, usually the finer grained, and command a higher market price.

Calf and kip whole leathers also are similar, but the kip leathers are usually the larger and the coarser grained and bring a lesser price.

Kip sides and whole kips are both used for making leathers for shoe uppers, leather goods, etc.

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Kola Nuts

THE kola nut is the brown, bitter nut of two tropical trees cultivated in the West Indies, Brazil, and Africa. It is nearly the size of a chestnut, extremely hard, and contains a large proportion of caffeine and some theobromine. The nut is chewed as a condiment and stimulant, and the extract is used as a tonic drink.

The bulk of imports come from West Indies and Africa, but more imports of Brazil kola nuts are developing as a result of shipping difficulties in connection with the movement of these nuts from Africa.

Kola nuts are packed in bags of 175 to 180-lbs. each. The trading unit is the pound. These nuts are ground for the production of kola extract and powdered kola. The resultant products are used commercially in the manufacture of soft drinks and in some dessert preparations. The manufacture of kola drinks, which has received a sharp impetus within the past few years, has suffered somewhat from the sugar shortage. However, numerous manufacturers are now marketing kola extract through the grocery and confectionery and drug trades for home preparation of kola drinks.

Kola extract is packed generally in 25 pound cans, and sold at $1.25 per pound in

July, 1942. The powdered, which is packed in various weight containers, sells at 11 cents per pound for granulated and 13 cents per pound for powdered. The kola nut in untreated form sells for 8 cents per pound.

Keeping qualities of the nut are good and normal cool storage suffices.

Kola nuts are imported duty free.

Kola preparations come within the provisions of the General Maximum Price Regulation.

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Kraft Board

See Paper

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Kyanite

KYANITE is a natural mineral, Aluminum Silicate. It is mined, crushed, separated by flotation with reagents, dried and ground to various sizes. In the United States shipments in 1940 were 4,241 short tons against 2,950 tons in 1939. California and Virginia are the leading producing states. Imports in 1940, all from British India, jumped to 7,658 tons from 3,964 in 1939.

Kyanite has a fusion point above Cone 35. It is converted to Mullite at 3000° F. and is then extremely stable. At about 2000° F. it changes in structure with a decided expansion in volume, a property which is used to control shrinkage of clay bodies. Kyanite cements are valued in the high temperature field. In glassware, it contributes a high percentage of alumina replacing alumina hydrate and other bauxite derivatives. It is an important ingredient of heat-resisting glassware. Marketing is in 100-pound bags. Prices as of May, 1942, ranged from $22.00 to $85.00 per ton depending upon quality and screen analysis. Screen sizes, as ordered, run from 48 mesh to 325 mesh. Two principal grades are: Glassmakers and Refractory. Bauxite derivatives and refractory clays are listed as substitutes.

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Lactic Acid

LACTIC ACID is a yellowish to colorless, viscous liquid, miscible in water, alcohol and ether. Commercially, it is obtained as a byproduct in the dairy industry by fermenting milk, and also by the fermentation of other starches, sugars, or mashes prepared from potatoes and corn. As it forms in the fermentation process it is neutralized with calcium or zinc carbonate, the lactate solution is then concentrated, sulfuric acid added to free the lactic acid, and the product distilled. Sulfuric acid may form an impurity in certain commercial batches of the acid.

The following are offered in commerce: 75 and 85 per cent grades meeting United States Pharmacopeia standards; edible, light grades in concentrations of 22, 44, and 50 per cent; a light, plastic grade in a 50 per cent concentration; and dark, technical grades of 22 and 44 per cent. The plastic grade is the more expensive of the industrial varieties. The medicinal grade is most expensive. Sales of the edible grade in 1940 amounted to 1,492,301 pounds, valued at $309,324. In 1939, comparable figures were 1,280,235 pounds, valued at $270,327. Sales of technical grades of lactic acid in 1940 in the United States totaled 1,671,237 pounds, valued at $212,276; while 1939 sales of the latter types totaled 1,439,401 pounds, valued at $168,572. All quantities are calculated on a 100 per cent acid basis. Technical grades of the acid are shipped in 450 and 500-pound barrels; while medicinal grades are packed in 100 and 120-pound carboys and smaller bottles.

The technical grades of lactic acid are used in textile dyeing and printing and as a deliming agent in leather manufacture in addition to plastics production. The edible

grades are employed in the production of sauerkraut, cheese, pickled items, and beer.

The price of technical, dark, 22 per cent lactic acid in recent years has been approximately $3.00 per 100 pounds. The edible, 50 per cent grade has been selling for 11 to 12¢ per pound. The plastic grade has been quoted at from 13 to 14¢ per pound.

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Lake Herring

See Whitefish

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Lamb

NINE-TENTHS of the world's population live north of the equator; nearly half of the world's sheep grow south of it. Hence there is normally a movement of wool and lamb from such countries as Australia (with about 117,000,000 sheep in 1940, or probably about a sixth of the world's total), Argentina (with about 44,000,000 in 1937, the latest estimate received), and New Zealand (with 31,000,000 in 1940) to Great Britain and other countries which raise more people and less sheep. And the importance of Australia to the allied cause in the present war, or the potential value of South America to a yearning enemy, may be better appreciated when a paragraph from the Purdue News Service is recalled: "Each soldier in the U. S. army requires the wool from 26 sheep to provide him with wool equipment the first year and then it requires the wool from 10 sheep for the maintenance of his clothing after the first year."

Due to its high value per pound, it is said that wool can be shipped farther at a profit than any other principal farm product—hence its production in frontier regions in large part.

Yet the world's sheep population is more evenly distributed among the continents than are either cattle or hogs. Asia boasts nearly half of the cattle, and both Africa and Australia have hardly enough hogs to count, but any continent you care to name can claim at least 60,000,000 sheep, and the one coming nearest that minimum is—North America! South America and Africa each have about half again that many, and Asia (not counting Russia) about twice that many, as had Europe (omitting Russia) before the present war. And if you wonder why neither Hitler nor Napoleon could hold his own in Russia in winter, look at some wool-bearing figures: in some recent year Russia had nearly 85,000,000 sheep, France 10,000,000, Germany about 6,000,000.

In the United States at the start of each year in the last thirteen, there have been between 51,000,000 and 56,000,000 sheep. The country's hog population in the same period has averaged about the same. But apparently sheep are more remote than the hogs from the newspapers and the radio, and less inclined to be disturbed by market price fluctuation reports; or perhaps they graze serene in the feeling that with a non-perishable product like wool for an anchor, they need not fear so much the price crests and troughs of perishables like lamb or pork; at any rate, while the country's January 1 hog population within the last twenty years has dropped from about 69,000,000 in four different dips, three stopping above the 50,000,000 mark but one continuing to 43,000,000, with two recoveries to 60,000,000 since, sheep in the same period have climbed almost uninterruptedly from 37,000,000 to their present 56,000,000.

Nearly seven-eighths of these sheep are grown west of the Mississippi river—almost half the number being in the Rocky Mountain and Pacific states, and about 11,000,000 in the western half of the Corn Belt. More than 10,000,000 are in Texas; having quadrupled its sheep population in the last two decades, Texas alone now boasts nearly as many sheep

as have any three of its nearest rivals put together (Montana, Wyoming, New Mexico, and California, the first two with about 4,000,000 each, and the last two with more than 3,000,000). Yet one of the largest sheep-producing states stands out in the East like an island — Ohio, which on January 1 of the present year had almost 2,300,000 sheep, or more than could be found in Idaho, or in Arizona, Nevada, and Washington put together! The most amazing island of sheep, however, is found in central southwestern Texas, where about forty of that state's 254 counties (comprising roughly a triangle stretching northward from Eagle Pass to Pecos on the west and almost to Waco on the east) grow millions of sheep more than does any entire state except Texas.

Millions of Americans possibly have never tasted mutton, as perhaps nine-tenths of the lamb and mutton produced in this country is marketed in the lamb stage, and as lamb consumption is centered in a few areas. Consumer demand prefers a 35-to-40-pound lamb carcass with a leg of lamb weighing from five to seven pounds. For the country as a whole lamb consumption usually averages from six to seven pounds per year, but after a study of the distribution of this consumption in 1936 the American Meat Institute estimated that New York, New Jersey, and Pennsylvania, eating about fourteen pounds per capita, consumed about 46% of the total. The three Pacific states, taking about thirteen pounds per person, and the six New England states, eating about 11½ pounds, together consumed another quarter of the total. This left only about 29% for all the rest of the country, and nearly half of that went to the Great Lakes states from Wisconsin to Ohio, with an estimated average of 4½ pounds per capita. The Rocky Mountain states, with their smaller populations, ate nearly nine pounds of lamb per person, but consumed only about 4% of the total. In the South and the western Corn Belt lamb consumption was apparently only from one to three pounds per person per year.

Lamb is scarcest and brings the best price in the spring and summer. Hence there is constant competition among the farmers of various sections to get their lambs to market as quickly as possible, and states with mild winter and spring climates reach the market first. The panorama changes with the calendar. First come the California lambs, rushed across the country by the carload for packinghouses in the Midwest, or dressed in California to speed from coast to coast by fast express in March or April or May. In the meantime spring has peeped into the hills of Tennessee and Kentucky, and out pour the lambs, beginning the latter part of April if it's an early spring, or early May if a late one; they continue through June and July, with the Kentucky season following that of Tennessee by about two weeks.

Idaho, Washington, Oregon, Montana, and Wyoming are large producers in the late summer and autumn. Idaho gets an earlier start than the others in this group by raising and feeding many of her lambs under shelter, to reach the market perhaps as early as May. Idaho and Washington predominate in the big range runs in August, and the other three states in those of September and October. Many of these northwestern lambs are bought on the market by feeders rather than processors, and are taken to the cornfields of Indiana, Michigan, Illinois, Wisconsin, Iowa, and adjoining states to clean up the weeds, the corn leaves, the fence rows, and finally the husks and grain. When winter arrives and the price of lambs is better, they are returned to market at weights from fifteen to twenty-five pounds heavier.

Spring lambs from Missouri also usually come to market in May. And as spring retreats up the California coastline, or climbs the successively higher ridges of the Sierras at a leisurely pace, it's soon springtime and lamb-shipping time in Idaho and Washington.

Virginia lambs begin to reach the market about June 1, and in about two weeks more, those from West Virginia and Ohio. July usually brings the lamb crop from Michigan, Wisconsin, and the Corn Belt states, and from Pennsylvania, New York, and other eastern states.

Autumn and winter feeding is also practiced, particularly in the irrigated alfalfa districts of Nebraska and Colorado, which help to supply the winter lamb market until spring swings back to California to start the yearly cycle again.

In Ohio and other eastern states a limited number of lambs are fed under shelter for the very early trade in young spring lambs, for sale principally to fashionable hotels and hotel supply companies. They are called "hot-house lambs."

Most of the sheep in Texas and other southwestern states are kept primarily for their wool. (Texas shears about 9,800,000 sheep per year.) Marketings of lambs from these states are proportionately small, and in many cases the lambs are sold to midwestern feeders for further fattening. Texas lamb marketings are heaviest in April, May, and June.

Denver leads Chicago as a lamb market, and the two combined receive about 5,000,000 sheep per year. Omaha, Ogden, Jersey City, Kansas City, St. Paul, and Fort Worth usually receive more than 1,000,000 a year each. St. Joseph, Pittsburgh, East St. Louis, Sioux City, Salt Lake City, and Buffalo receive more than 500,000 each. Denver returns approximately 1,000,000 lambs per year to the farm for further feeding, and Omaha, Ogden, Sioux City, Fort Worth, Kansas City, St. Joseph, and St. Paul return from 150,000 to 400,000 each for this purpose.

Meat packers of the United States supply about 65,000,000 pounds of wool per year. This is called "pulled" wool, in distinction from the shorn wool from sheep still living, and it normally constitutes more than a seventh of the country's wool production. The latter, in turn, ordinarily comprises about a ninth of the total world production—of which Australia supplies about a fourth, South America about a sixth, Europe (excluding Russia) about a seventh, and Africa and New Zealand each about one eleventh.

Even in peace-time the United States is a heavy importer of wool. During the previous world war, our wool consumption jumped from about 250,000,000 pounds to about 800,000,000, with domestic production advancing only from 277,000,000 pounds to 318,000,000. In the present period United States wool production again has increased slightly (from 428,000,000 pounds in 1939 to 455,000,000 in 1941), and wool consumption began its climb with a jump from 641,000,000 pounds in 1940 to 707,000,000 in only the first nine months of 1941.

It has been claimed that there are more distinguishable types and grades of wool than of any other world product. One of them is carpet wool (not included in the above figures), of which the United States uses about 100,000,000 pounds per year — all being imported.

Lamb is wholesaled either in the carcass or in cuts, and is wrapped in paper or in stockinette bags. Pulled wool is sold in bales; shorn wool in burlap bags.

Despite their importance in the modern world as well as the ancient one, sheep have perhaps been influenced less by the advance of civilization than any other domestic animal, with the possible exceptions of the cat or the camel. The ox has been turned into a highly efficient meat factory; the cow into a dairy specialist. The noble horse has often been sentenced to weary labor, and then largely side-tracked for a metal counterpart that eats no hay (or sugar!), but does more work; the dog, in part, has been penned in towering apartment buildings and turned into a toy. But the typical sheep lives more

or less serenely as he lived in Bible times, in herds that practically own the frontier lands upon which they graze, with herders who still forsake the rest of the world (unless today they take along their radios!) to spend day and night with their sheep. And when your auto as an ambassador of a hurried modern civilization meets a thousand sheep jammed like bees in a slowly-moving monopoly of some stretch of western roadway, it is your speeding but transient honkmobile, not the calm and soft and timeless herd, which stops to yield the right of way!

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Lambs

See Sheep

★ ★ ★

Lambskins

See Sheepskins

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Lanthanum

See Monazite

★ ★ ★

Larch

See Spruce

★ ★ ★

Lard

LARD is one of the most important products of the hog and of the midwestern farm. About a fifth of the dressed pork carcass goes into lard, and the lard that comes out of the process weighs about an eighth of what Mr. Hog in person weighed on the hoof.

Incidentally, the hog's fatter portions comprise sort of a bargain counter for Mrs. Consumer. First of all, fats are nature's richest food sources of energy, offering more than twice as much fuel value per pound as either proteins or carbohydrates. And in the second place, lard is one of the very few food products often sold to the consumer at a price per pound little if any higher than was originally paid the farmer per pound of raw material (in this case per pound of hog).

In the days when nearly everybody lived on the farm, or practically there, the economics of existence weren't so complicated, and fats could be appreciated in proportion to their value rather than the fitful whims of price. Thus an Englishman, William Cobbett, in telling families how to raise a hog, in his book on "Cottage Economy" in 1823, suggested: "Make him quite fat. If he can walk two hundred yards at a time, he is not well-fatted. The last bushel, even if he sit as he eat, is the most profitable."

In Germany and other European countries lard is often used as a spread for bread. Of this practice Mr. Cobbett similarly observed a century ago, "Country-children are badly brought up, if they do not like sweet lard spread upon bread, as we spread butter."

The people of the United States consume from ten to fifteen pounds of lard per person per year, according to how many hogs and what-sized hogs the farmers happen to raise and market in the months just preceding. For the forty-three years for which Government estimates are available, the average is about $12\frac{1}{2}$ pounds. The record of fifteen pounds was set in 1940, and was almost reached again in 1941. The lowest figure was 9.6 pounds, in the hog-shortage year of 1935.

From 1900 through 1934, the United States usually exported half a billion pounds of lard per year, or more. From 1919 to 1929 the figure was usually nearer a billion, the largest being in 1923, with more than a billion. From 1935 to 1940 European tariffs and the difficulties of international exchange cut down this market to about a sixth of that figure, on the average. Since the passage of the Lend-Lease act, of course, there has been a considerable in-

crease in lard exports. And under compulsion to conserve shipping space, American ingenuity has even learned to use frozen lard as a refrigerant for meat shipments abroad; the lard keeps the meat in perfect condition, and on arrival the lard also is suitable for consumption.

Lard was the all-purpose shortening of American housewives for many generations. After the bulk of the population shifted to town or city, most housewives ceased to make lard and many forgot how to use it. Special procedures have been developed for its use in cake-baking — procedures that probably wouldn't have been new at all to Grandmother back on the farm! Recently military necessity has prompted the development of special lards for army use, which can be shipped long distances under varying weather conditions.

As prepared for home consumption, lard falls into two general classes; kettle rendered lard; and refined lard, either steam or dry rendered. Kettle rendered lard, in a grainy form, was the only kind until about sixty years ago, when the need of greater firmness in lard intended for the export trade prompted the invention of the "chill roll," or refrigerated drum.

Rendering is the heating process which separates the fats of the hog from moisture and interconnecting tissues. Kettle rendered lard is prepared in steam jacketed kettles at temperatures from 240 to 260 degrees Fahrenheit. It is light in color, usually grainy in texture, and of good keeping quality. Because of its pleasing flavor, it is often chosen for frying, or as the shortening for breads, pastries, and many kinds of cakes and cookies. A variety of kettle rendered lard is known as leaf lard, because it is made only from the abdominal or "leaf" fat, which is considered the choicest fat of the hog. It is distinguished from other lards by its hardness.

Refined lard (usually labeled "pure lard") is rendered by injecting steam, at about 285 degrees Fahrenheit, and under forty to sixty pounds pressure, into a closed tank of raw fat; or by boiling off the moisture from the fats in enclosed steam-jacketed kettles, this being called "dry rendering." In either case, to give a firmer texture, most of the cooling is done on the refrigerated drum, instead of more slowly in the final containers. Refined lard is usually smooth in texture, and light in color. When sold in cartons it is sometimes called "print" lard. It now represents the great bulk of the commercial product, but the lard roll or drum,—an invention which was to bring the refining of export lard to America,—had an uphill battle for years, because American housewives by the thousand reasoned, "It isn't *grainy*, so it *can't* be lard."

Even today, however, either kettle rendered or refined lard may be either smooth or grainy according to whether it was cooled over a lard roll or not.

There are also on the market hydrogenated lard, which is firm, creamy white, neutral in flavor, and of excellent keeping quality; and "neutral" lard, which is rendered at low temperatures for use mainly in oleomargarines.

The refusal of matrons of an earlier day to accept lard that was not grainy has its present counterpart in the demand of many housewives that lard be unnaturally white. The natural color of lard does not affect, in any detectable manner, any product made from it, except that artificial whiteness is actually a loss instead of a gain. Lards having a slight cast, for example, are very stable lards; yet there is a prejudice against them in some quarters, and the packer is forced to cultivate an intruder, whiteness, at the expense of a valuable ally, stability.

The following statements summarizing the nutritional values and uses of lard have been approved by the Council on Foods and Nutrition of the American Medical Association:

Lard is a highly digestible (97%) cooking

fat, very rich in total calories. It is a valuable shortening agent and its flavor makes it desirable as a general cooking fat.

Lard is all fat—and fats are our richest energy foods.

Of all cooking fats, lard is often the most economical.

It lends a delicious flavor to pies, breads, cakes, etc.; and in frying also it enhances food flavor.

It is conveniently available in various package sizes; when given a spot in the refrigerator it keeps well; and it is workable over a wide range of temperature.

Lard is a good source of various unsaturated fatty acids which experimental work on animals indicates may be of value in nutrition.

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Lava

See Talc

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Lavender Oil

LAVENDER or lavender flower oil is a colorless yellowish or greenish-yellow oil obtained by steam distillation of several variations of lavender blossoms, especially Lavandula vera. The plant is native to the area of the lower Alps bordering on the Mediterranean. French lavender oil is obtained largely from wild plants. In England, however, the oil is distilled almost entirely from cultivated plants. The best known of the English production areas are in Surrey, Suffolk, and Hertfordshire.

The more common oil in commerce is the French oil, which contains from 30% to 40% of linalyl acetate. The English contains a smaller amount of esters than the French oil, but more of other ingredients, and a difference in odors is therefore noticeable. The English oil is considered the finer oil. Commercial quotations are on the basis of ester content.

A lavender-spike oil, or aspic oil, is also important commercially. This spike oil is obtaned from Lavandula spica, yellow in color, and has odor combining lavender and rosemary. Spain is the most important supplier of the spike oil. Lavender-spike oil is used in technical manner only and is packed in drums of about 400 pounds and tins of 50 pounds. The lavender flower oil is packaged in tins weighing 28 pounds, and is used in perfumery.

United States imports of lavender flower oil during 1940 were 92,457 pounds, valued at $231,939. France was the largest single supplier, with 87,862 pounds. In 1939, 325,931 pounds of the flower oil were imported, having a value of $573,253. France in that year supplied 322,897 pounds. Lavender-spike oil imports in 1940 were 139,-088 pounds, valued at $163,530. Spain contributed 134,801 pounds of the total. In 1939, Lavender-spike oil imports amounted to 87,492 pounds, valued at $110,011. Spain exported 57,937 pounds to the United States in 1939.

French lavender oil was in a scarce position on June 1, 1942 and quotations were nominal. On January 1, 1942, however, this material was priced at from $7.50 to $11.50, according to ester content; and at the start of 1941 prices ranged from $5.00 to $8.50 per pound. Lavender-spike oil on June 1, 1942 was priced at $4.25 per pound. At the beginning of the year, the spike oil was priced at $2.75 per pound, and at the same time in 1941 it was quoted at about $1.40 per pound.

* * *

Lead

LEAD, a dull, gray, soft, heavy metal, occurs in nature generally as a lead sulphide mineral known as galena, and usually

in association with other metals, notably silver and zinc. Two other lead minerals of minor importance are cerrusite and anglesite. Low grade ores found in Missouri may have a lead content as low as 3 percent, whereas ores in the Rocky Mountain regions, more costly to mine, carry about 10 percent lead.

While lead is one of the most stable of metals, it becomes hard and brittle if melted too often. Its melting point is 621° F.; boiling point 2777° F.; and specific gravity 11.38. It has a low tensile strength, is soluble in nitric acid, less soluble in hydrochloric acid and practically insoluble in sulphuric acid.

After mining, the lead is concentrated (unless the lead content is unusually high), eliminating waste rock, and then smelted and refined to remove impurities and other metals, the latter becoming valuable by-products in many cases. The refined lead is then cast into bars or pigs weighing from 80 to 100 pounds for shipment to manufacturers.

Some large lead companies smelt and refine their own concentrates, but the production of other large, and most smaller mines, is sold to custom smelters. They purchase ores or concentrates outright and sell resulting pig lead along with their own production if they have any. In addition, most smelters of lead ores produce refined pig lead, using secondary or scrap metal from old battery plates, pipe and cable sleeving, as their raw material.

Imports of lead have only been of great importance since the war began and currently amount to about 40 percent of the total supply.

In 1939 the United States production was 420,427 tons compared with an estimated world production of 1,898,968 tons. Other large producers, in order of importance, are Mexico, Australia, Canada, Germany, Belgium and Burma.

In 1941 United States production had risen to 460,665 tons while world production figures were not obtainable. Domestically, the largest mine production by states is from Missouri, Idaho, Utah, Oklahoma, Montana, Kansas, Arizona and Colorado.

Lead is sold in pigs or bars weighing 100 pounds, usually in minimum carloads of 20 to 40 tons. The June, 1942, price for the common grade was 6.50¢ per pound New York and 6.60¢ for chemical and corroding grades.

The American Society for Testing Materials has established standards for seven grades of pig lead: Corroding lead, chemical lead, acid lead, copper lead, common desilverized A lead, common desilverized B lead, and soft undesilverized lead.

The United States duty on lead ore and concentrates is 1½¢ per pound and on the bullion and pig, 2⅛¢ per pound. However, Government agencies now have the power of importing essential war commodities at any high price they care to pay to stimulate imports despite the duty. This is being done for Mexican, South American, Australian and Canadian lead at present.

In 1939, the American Bureau of Metal Statistics listed 667,000 tons of lead used by industry. Storage batteries led the list at 198,000 tons; White lead 75,000; cable covering 74,400; Red lead and litharge 57,200; building 50,000; ammunition 42,300; foil 21,800; calking 16,000; typemetal 14,000; bearings 12,000; automobiles 8,900; castings 7,500; terne plate 5,400; and miscellaneous use 63,700 tons.

The war production program, of course, brought a drastic change in the uses of lead. It is employed extensively for bullets, in the equipment used to manufacture high explosives, in storage batteries for submarines, tanks, airplanes, etc., in degaussing cable, in tetraethyl lead in gasoline, in lead azide as a detonator, in plumbing for defense housing, in paint for ships, in bearing materials and in many other direct and indirect war

use. The result of this increased demand has meant the curtailment of use in certain civilian industries such as the automobile industry, foil wrappings and casket hardware.

The War Production Board under Order M-38 (also M-38-a, b, c, d, e, and g) has controlled its use, directed the amount of lead to be set aside by each refiner, etc.

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Leather

See Cattlehides

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Lecithin

LECITHIN is a plastic fat-like substance containing glycero-phosphoric acid and choline. The commercial product is a mixture of lecithin and associated phosphatides in a carrier of oil. It is obtained chiefly in connection with the solvent extraction of soybeans. Production is centered in Illinois and adjacent States. It is used for its colloidal and anti-oxidant effects, as in chocolate, oleomargarine, cosmetics, textiles, etc. There is some use in medicine. It is sold by the pound; a recent quantity price being 35¢. It is shipped, by rail and truck, in drums. Properly stored it will keep for years. Principal grades are: bleached and purified. Other emulsifiers and anti-oxidants may be used as substitutes. The U. S. import duty is 20 percent ad valorem.

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Lemongrass Oil

LEMONGRASS or Indian verbena oil is a yellow to brown oil having a fragrant odor, obtained by distillation. Formerly the oil was produced entirely in the East Indies. In recent years, however, production has been established in Brazil, Guatemala and Florida. During pilot plant operations in 1937 and 1938, 240 acres of Florida land not suited for sugar cane culture were planted with lemongrass. The oil yield approximated 12 tons. Considerable expansion has been made since 1938, it is reported, to aid American lemongrass oil users through the war crisis.

Imports of lemongrass oil in 1940 amounted to 380,231 pounds, valued at $194,612. British India supplied 263,228 pounds during 1940; and Guatemala, 116,229 pounds. In 1939, 530,746 pounds of lemongrass oil were imported, with a valuation of $171,203. In that year British India supplied 463,814 pounds, and Guatemala, 63,915 pounds. Native lemongrass oil is shipped in drums weighing about 400 pounds, and canisters of 50 pounds. A redistilled grade is offered in 25-pound tins.

Lemongrass oil finds application in various perfume combinations and in industrial products as an inexpensive odorant. The price of the native oil on June 1, 1942 was $4.00 per pound. At the first of the year it was priced at $3.00. A year earlier, on January 1, 1941, it was 78¢ per pound.

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Lemon Oil

LEMON OIL is a bright yellow liquid obtained by expressing the fresh peel of the nearly ripe fruit of Citrus medica. Lemons, today, are grown for oil production principally in the countries bordering the Mediterranean, with Sicily the leading site of production; and in California. Quantity production of the oil in the latter state started in 1929. Before that time Italy was practically the sole supplier. However, a few years after American production had started it was satisfying 75% of our domestic needs. In 1941, California supplied an even higher percentage of the oil consumed in this country, it is estimated.

The rise of California production is

clearly shown in a comparison of lemon oil importations. In 1929, Italy shipped 384,370 pounds of oil to this country. Ten years later, in 1939, the total United States imports had fallen to 148,235 pounds, valued at $296,014; with Italy's share amounting to 140,237 pounds. In 1940 a further decline, to 86,489 pounds, valued at $211,496, was shown in the total. Italy in 1940 supplied 84,290 pounds. Thus, it is opined by some in the trade, the Italian lemon oil market in the United States which has been badly shaken in the past ten years may be broken by World War II.

Italian lemon oil is offered commercially in 25-pound cases and in one-pound copper flasks. The domestic expressed oil is packed in 25-pound tins. In addition to the native lemon oils, terpeneless oils and "five-fold" oils of domestic and Italian origin are also common commercially. The latter products are offered in five-pound and one-pound bottles, respectively. Imitation expressed types of lemon oil, which do not meet United States Pharmacopeial standards are also commercially available, packed in 25-pound tins. Imports of terpeneless lemon oil in 1940 amounted to 1,542 pounds, valued at $19,722. Netherlands was the largest supplier with 920 pounds. In 1939, the Netherlands was also first with 472 pounds, in a total of 1,184 pounds, valued at $15,988.

The lemon oils are employed mostly as flavoring agents, especially in the soft drink industry. Quantities also enter the perfume industry, especially in soap odorization. The price of California oil on June 1, 1942 was $3.25 per pound. This price was also in effect at the beginning of 1942 and 1941. The Messina, or Italian, oil on June 1, 1942 was priced at from $5.50 to $8.00 per pound. On January 1, 1942 it was at about the same level, while a year before it was priced at about $4.75 per pound. Terpeneless oils on June 1, 1942 ranged from $9.00 to $15.00 per pound, which prices have remained approximately the same since January 1, 1941.

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Lemons

The lemon is the acid fruit of the lemon tree. The rind is often prepared in candied or preserved form. Lemon juice was formerly the chief source of citric acid; however, the synthetic product has now replaced the natural citric acid in commercial use. Lemons are used in cookery, in beverages, and as an antiscorbutic. The domestic market is supplied from California, imports from Italy and Spain having fallen to negligible proportions even before the war.

The principal commercial uses of lemons are in beverages, flavoring extracts, confectionery, and in commercial baking (lemon peels, candied.) The bulk of the production is sold for consumer use in natural form.

Lemons are purchased from the grower by the field box, although most of the crop is marketed cooperatively, the fruit being packed, shipped, and sold, mostly in central fruit auctions, by the box, with the price dependent upon the size of the fruit, its condition, and current market demand. Lemons are susceptible to weather damage, and are generally shipped by rail in refrigerator cars, with truck shipments to markets in nearby producing areas.

Shipments of lemons from California for the past five marketing seasons were as follows:

	—Cars—
1936-37	14,096
1937-38	16,103
1938-39	17,471
1939-40	16,840
1940-41	20,002

Lemon juice was canned commercially in a limited way prior to the War Production Board tin conservation order, which halted this operation. It is also packed in bottles

to a limited extent, and is being increasingly prepared in concentrated liquid form, and in powder, for home, commercial, and institutional use.

Lemon peel, candied, is used as a substitute for citron. It is packed in 50-pound wood or solid fibre boxes and ranges from 19 to 22 cents per pound in July, 1942.

Import duty on lemons is $2\frac{1}{2}$ cents per pound.

Lemons do not come under the General Maximum Price Regulation.

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Lentils

Lentils are a flattened lens-shaped seed, the product of the lentil plant. They are cooked like peas or beans and are also ground to meal. While the lentil originated in Eurasian countries, it is now largely grown in South America. Before the war, imports came from Poland, Czecho-Slovakia, and Africa. Now the domestic market is supplied largely from Chile.

While lentils were canned to a limited extent prior to the War Production Board tin conservation order, which stopped the canning of such products, they are marketed generally in unprocessed form to the consumer through normal trade channels, and have little commercial utilization. Canned lentil soup, marketed to some extent in recent years, has been curtailed by tin conservation measures.

The principal market grades are Jumbos and Giants.

Data on South American production is not available, although supplies have been adequate, despite the shipping difficulties arising from enemy submarine action.

The unit of purchase from the primary market shipper is the pound, and the July, 1942, market at New York were $5\frac{1}{4}$ to $5\frac{1}{2}$ cents per pound for Giant and 5 to $5\frac{1}{4}$ cents for Jumbos, both duty paid.

Lentils are imported in bags, running 100 to 120 pounds, and this is the container used in wholesale trading in this country. For the consumer trade, importers and distributors package the lentils in 12 to 14 ounce packages, the trading unit in such cases being the dozen packages.

Lentils are susceptible to weevil infestation, and require cool, but not cold storage for proper handling.

Substitutes for lentils are any of the other varieties of dried beans or peas.

The duty on lentils is one-half cent per pound.

Lentils come under the jurisdiction of the General Maximum Price Regulation.

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Lignin

See Plastics

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Lime

Lime, calcium oxide (CaO), is obtained by heating limestone in a furnace—calcinating. Commercial limes normally contain about 94 percent calcium oxide, some calcium carbonate and usually less than one percent magnesia, although thin, slower-slaking limes with a higher magnesia content are also marketed.

Addition of water to lime causes it to "slake", and produce a white powder. In the slaking process, heat is produced and a rapid expansion occurs. Quicklime or caustic lime, are terms applied to the calcinated product. Hydrated lime is made from ground quicklime which has been slaked to a fine powder.

Production of lime attained a peak of 4,886,929 short tons in 1940 and is understood to have attained an even greater volume since then. Exports of lime in 1940 totaled 31,912 tons—also a new high.

Quicklime sold in 1940 totaled 3,501,104

tons valued at $23,433,807 while sales of hydrated lime were 1,385,825 tons valued at $10,522,578. Chemical and industrial uses needed 2,643,762 tons of both types; the building industry, 1,010,435 tons; refractory (dead-burned dolomite), 867,909 tons; and agricultural sales were 364,823 tons. Quicklime is a semi-perishable commodity; and for this reason, stocks are always inconsequential.

Lime was produced in 38 states and 2 territories in 1940 with the output coming from 314 plants. Principal producing states were Ohio (1,284,877 tons); Pennsylvania (833,038 tons); and Missouri (607,062 tons).

The metallurgical industry used 999,215 tons of lime in 1940; paper mills 566,818 tons; water purification 266,088 tons; glassworks 168,044 tons; tanneries 72,417 tons; sugar refineries 19,089 tons; and "other uses", in the chemical and industrial use, accounted for 552,091 tons.

Refractory lime sales (dead-burned dolomite) totaled 867,909 tons in 1940 against 671,561 tons in 1939. Dolomite is a type of limestone employed in cement making, as a flux in melting iron and as a lining for basic-steel furnaces. The dead-burned (calcinated) variety is only used for furnace linings and the crushed stone is utilized for fluxing operations.

In addition to quicklime and hydrated lime used for agriculture, lime for that purpose is obtained from oyster shells (10,220 tons of lime content in 1939). Crushed oyster shells are also used (35,100 tons of lime content in 1939). Calcareous marl with a lime content of 11,500 tons was reported sold or used in 1940.

Chemical and industrial lime sold or used by producers in the United States for "other uses" in 1940, as mentioned earlier, went to hundreds of different industries. Principal uses were: calcium carbide and cyanamide 88,011 tons; insecticides, disinfectants, etc., 54,630 tons; magnesia 45,658 tons; paints 28,083 tons; petroleum refining 29,344 tons; sewage and trade waste treatment 19,158 tons; brick, sand, lime and slag 18,620 tons; refractory brick 15,356 tons; alkalies (ammonium, potassium, and sodium compounds) 15,238 tons; coke and gas 14,139 tons; bleaching, excluding for paper manufacture, 10,608 tons; polishing compounds 6,346 tons; soap and fat 6,855 tons; salt refining 5,381 tons; tobacco 5,375 tons; varnish 4,540 tons; food products 7,225 tons; glue 8,057 tons, etc.

In mid-1942, lime (quicklime, chemical, lump or pebble, in bulk f.o.b. factory) was priced at from about $6.00 to $10.00 per ton in the eastern states, and at $16.00 in San Francisco. Spray lime, in paper bags, ranged in price from about $8.50 to $11.00 per ton f.o.b.

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Limestone

LIMESTONE is the most widely used type of rock employed in crushed and broken form. It is used so extensively because it can be quarried and crushed at moderate cost, is available in a multitude of markets, and is essential to many chemical and manufacturing industries. In 1940, limestone comprised 74 percent of all crushed and broken stone sold in the U. S. (excluding that used for making cement and lime). Total sales were 111,575,930 short tons valued at $98,747,340. Crushed stone for concrete and road metal accounted for 60,934,100 tons. The iron and steel industry took 22,856,910 tons for use as a "fluxing" agent. Sales for use as riprap totaled 3,243,360 tons; railroad ballast 5,085,410 tons; 8,724,160 tons were for agriculture; and 10,731,990 tons went for other uses.

The present high level of iron and steel production has brought a record-breaking demand for limestone. The manufacture of iron requires about 26 tons of limestone for

every hundred tons of ore and eighty-four tons of coal, the three principal raw materials.

Pennsylvania, Ohio and Michigan are the principal producers of limestone with New York, Illinois, Missouri, Tennessee, Virginia not far behind. Indiana, Iowa, Kentucky, West Virginia, Wisconsin, Texas, Alabama and Georgia, all produce over a million tons annually.

Marble, chalk and dolomite are—in the broadest sense—forms of limestone.

Calcination of limestone, $CaCO_3$, results in lime, CaO. (see Lime).

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Lime Oil

LIME OIL is obtained by expression or distillation of the peel of Citrus medica, variety acida. The best oil is produced by cold expression and is golden yellow in color. The distilled oil has an unpleasant therebinthinate odor. Lime oil was formerly produced chiefly in the West Indies islands, and to some extent in British Guiana. For several years past, however, Mexico has expanded production until it now is the largest supplier to the United States.

In 1940, some 140,668 pounds of lime oil were imported into the United States. Mexico furnished 47,474 pounds; Trinidad and Tobago, 36,763 pounds; and other British West Indian islands, 34,572 pounds. The 1939 importation of lime oil amounted to 134,320 pounds, valued at $404,735. In that year Trinidad and Tobago supplied some 51,970 pounds; Mexico, 32,869 pounds; and other British West Indies, 24,897 pounds. Natural Mexican oil is packed commercially in 25-pound tin canisters. The West Indian oil is packed in 35-pound tins.

Lime oil is used principally in flavoring. A secondary use is in perfume combinations. Expressed lime oil on June 1, 1942 was priced at from $13.00 to $14.00 per pound. On January 1, 1942 the expressed oil was valued at about $12.50 per pound; while a year earlier its price was approximately $8.00 per pound. The distilled grades of lime oil on June 1, 1942 were priced at $11.00 to $13.00 per pound. At the beginning of 1942 the distilled oils ranged from $8.50 to $9.50; while at the same time in 1941 their price was about $5.00 per pound.

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Limes

THE lime is the small, globose greenish-yellow fruit of the lime tree, which had its origin in Asiatic countries. It is a juice fruit, with a very acid pulp of a characteristic flavor, and is very closely related to the lemon, being used similarly. It is widely cultivated in the British West Indies, Cuba, Mexico, and Puerto Rico, from whence most imports come. Domestic production centers in Florida, Texas, and California, and is increasing yearly as domestic use of limes expands.

Limes are sold by the grower on the basis of the bushel, but currently a strong trend toward packaging limes in units of one dozen, in cardboard cartons with transparent tops, is in evidence. During the 1941-42 season, the average return to Florida growers was $1.77 per bushel for limes sold in package form and $1.60 per bushel for bulk limes.

Limes are perishable and require cool storage. They are shipped mainly by truck, insofar as the domestic crop is concerned, and are imported in boxes and quarter-boxes.

There is little commercial use for limes, aside from their moderate use in the preparation of soda syrups for the confectionery trade, and a limited use of limes in proprietary drug products. Their sale is principally to hotels, bars, restaurants, and consumers. Their price in fresh fruit distributing mar-

kets varies widely, depending upon supply, weather conditions, etc.

Lemons may be used as a substitute for limes.

The import duty on limes is 2 cents per pound for both the fruit in its natural state and limes in brine.

Limes do not come under the General Maximum Price Regulation.

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Linen

A YARN spun from the fiber of the flax plant. The name also is applied to the cloth woven from the yarn.

Three operations take place in the production of yarn. The first is hackling or carding whereby the flax fibres are combed, disentangled and laid smooth in parallel fashion. Next comes the preparing operation, the object being the proper assortment into qualities fit for spinning and the drawing out of fibres so that a uniform continuous ribbon or sliver may be obtained. The third step is the spinning operation. A large portion of the commercial yarn is bleached before woven. Weaving entails similar steps to those taken in connection with cotton and other textiles.

The leading linen producing nations are Ireland, Belgium and France. Linen fabrics range from heavy sail-cloth and rough sacking to the most delicate cambrics. Sail-cloth is a leading product of the heavy manufacturers. Medium weight linens are used for outer garments for men, linings, upholstery work, towelling, covers, tent-making, etc. Plain bleached linens include the material for shirts, collars and bed sheets. Twilled linens are used in diapers, drills; damasks go into table linen. Among the fine linens are cambric, lawns, and handkerchiefs.

Substitutes are cotton, ramie, hemp, rayon and other fibres.

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Linseed

See Flaxseed

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Linseed Cake

See Linseed Oil

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Linseed Oil

LINSEED oil and cake are the most important products derived from flaxseed, or linseed. The seed contains from 32 to 42% of oil. In the process of expressing the oil, crushers seldom leave more than 6% of the oil in the cake and by-products. Linseed usually contains about 8% of water, the balance being fibre, albumins and mineral substances. The yield and the quality of the oil varies according to the origin of the seed, its percentage of water and the number of immature, musty and otherwise damaged seeds.

Linseed arrives at the mill containing various grains, chaff, broken stubble and weed seeds which must be cleaned out in order that it may enter the process as commercially clean as possible. It is cleaned by a system of sieves and dust collecting cyclones.

The process first described herein, commonly known as the "Old Process" and widely used today, is a process whereby the oil is expressed from the ground linseed by the use of the hydraulic press. The expeller method is also used extensively.

The linseed having been cleaned and stored in storage bins, is passed through chilled crushing rolls, there being about one set of rolls used to every two presses. The function of the rolls is not to express the oil, but simply to break down the structure of the kernel, by a flattening and grinding process, rendering the ground flaxseed in a flaky condition. This produces a stratified cake, which offers a minimum resistance

to the flow of oil in the press, as the laminations arrange themselves in planes at right angles to the line of pressure, thus forming channels for the oil to escape.

The ground seed is carried by screw conveyors from beneath the rolls to jacketed kettles or "cookers," there being approximately one compartment cooker for each room of 8 presses in most modern mills. This cooking is called "tempering." There is quite a diversity of opinion as to the best method of tempering linseed meal. In addition to having the proper degree of heat, the meal must also have the exact percentage of moisture necessary to soften the oil cells, and render the oil limpid, so that it will flow freely from the meal while under pressure in the press. The meal is kept in constant motion in the cooker to keep it from burning, and to distribute the heat evenly. When the proper temper is attained, the meal is drawn off at the bottom of the cooker into a cake-former.

The modern cake-former is a hydraulically operated machine designed to mould the meal into proper size and form to fit the press boxes of the hydraulic press. The meal is also given an initial pressing in the former to procure a compact cake, in order that the hydraulic presses can be built of an economical working height, without sacrificing capacity. To hold the cakes in the press and prevent them from squeezing out laterally when pressure is applied, it has been found necessary to use a hair cloth to wrap around the meal. This operation is performed by hand at the former, and the cake is then ready for the press.

The formed cakes are carried to the press, and when each compartment has been filled, the pressure is turned on by opening an automatic change valve. After this valve is once opened, the operator may go on filling the next press, and the pressure is controlled automatically. The presses are left under pressure one hour. The cakes are then pulled from the press, and the hair mats stripped off. This part of the work is done entirely by hand.

The cake is then trucked to the trimming machines where all the oily edges are trimmed off and run back through the process. The cake is either bagged for export or ground into meal to be used for feeding in this country. The raw oil as it comes from the press is run into a series of settling tanks, allowed to cool, and is then filtered and tanked for storage. It may then be shipped as raw oil or used in the refinery for making boiled or some grade of refined oil.

In the expeller method, the flaxseed are cleaned and rolled with the same type of equipment as for the hydraulic press mill. The coarsely rolled seed then passes into the cooker-dryer where, through the addition of heat and means of reducing the moisture content, the seed is tempered to an ideal condition for the extraction of the oil from the mechanical press, the cooker-dryer being used for this purpose. The French type mechanical press, with its water-cooled cage, makes it possible to process the tempered rolled flaxseed at a temperature that safeguards the quality of the oil and results in the making of a low oil content cake on a high tonnage basis. This is accomplished with a minimum of labor.

The oil from the press is filtered and the filtered foots are returned through the cooker-dryer with flaxseed for pressing. There is no tendency for the meats or foots to accumulate in the dryer and insulate the machine. It is always perfectly clean and can handle foots just as successfully as rolled seed. The cake is either coarse ground into a pea size or fine ground into meal and is ready for the market.

United States production during the 1940-41 crop year amounted to 868,057,000 pounds.

Linseed oil is considered the most im-

portant natural drying oil used in the protective coating field because of its inherent oxidizing property. This property of absorbing oxygen from the atmosphere makes linseed oil a protective coating unexcelled by any other natural drying oil.

There are two standard commercial grades of linseed oil, raw and boiled. Raw linseed oil is used principally in paints, foundry oils, putty and soap. Boiled linseed oil is most commonly used in reducing commercial white lead paste. In addition to these standard grades, there are approximately 50 different refined linseed oils used chiefly in the manufacture of paints, lacquers, enamels, varnishes, linoleum and oil cloth, patent leather, oiled clothing, imitation leathers and printing inks.

The marketing unit is the pound. The average price of linseed oil (raw, tank cars, Minneapolis) in March, 1942, was 12.4¢ per pound. The average price in New York for that month (raw drums, carlots) was 13.4¢ per pound.

Linseed oil is transported in tank steamers, tank cars, tank wagons, drums and various sized cans. Shipments to large consumers are generally made in either tank cars or carloads of drums and cans.

Substitutes include other vegetable oils. The duty is 4½ cents per pound.

The principal by-product in the manufacture of linseed oil by the "old process" is Old Process Linseed Cake, which, when ground into feed is known as Old Process Linseed Oil Meal. This is the ground product obtained after expression of part of the oil by crushing, cooking and hydraulic pressure. It is packed in cake form for export but is ground into meal for domestic consumption and shipped in bulk or 100 pound bags. Owing to the educational work undertaken by the crushers and the various agricultural colleges and experimental feeding stations, the American linseed meal is quite generally recognized and the demand absorbs almost the entire output of the American mills.

While linseed cake is really a by-product, its manufacture and sale are equal in importance to that of oil, and although netting a smaller price per pound, its value has a very great influence on the course of oil prices and the conduct of the business as a whole.

Linseed oil meal is a concentrated feeding stuff, and should be fed as a balanced ration by mixing with the proper amount of bulk feed commonly known as "filler." It is a high protein, high fat and low fibre product, and as such is a valuable feed as a flesh and milk producer. It is most extensively used by owners of high class and fancy-bred stock.

Linseed cake and meal production have expanded considerably in the last few years. The supply in the seasons of 1928 to 1932 averaged 310,000 tons. In 1940 it jumped to 742,000 tons and in 1941 to 875,000 tons. Prices for linseed meal (37% protein) in March, 1942, averaged $42 per ton at Minneapolis and $36.30 per ton at Buffalo. The duty on linseed cake and meal is 3/10th cents per pound.

Other by-products, of less importance and value, are wheat screenings, flax chaff, and various grades of coarse screenings, all of which are separated from the flaxseed as it is received at the mill. Wheat screenings are usually sold as chicken feed, or if of unusually good quality are sold directly to millers. Flax chaff is separated from the seed by a system of cyclones and dust collectors, and is sold to mixed feed dealers, being principally used in molasses feeds. The coarse screenings comprise various oleaginous and non-oleaginous materials such as broken straw, weed seeds, flax shives, flax pods, broken and immature flax seeds, and the cortical tissue of the straw —all of such size and shape as is possible to separate from the flax. These various

grades of screenings are usually sold on sample to mixed feed dealers, who use them as an ingredient of proprietary feeds usually containing molasses.

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Linseed Oil Meal

See Linseed Oil

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Lithopone

LITHOPONE is a white pigment of very fine particle size, consisting of barium sulphate and zinc sulphide. The United States production in 1941 was 160,434 tons. Principal uses are in enamels and interior paints, linoleum, oil cloth, shade cloth, paper, rubber, leather dressing, white shoe polish and printing inks. Marketing is in 50 lb. bags, usually in carload lots. There are two types of lithopone, Normal and Titanated, the latter containing a percentage of titanium dioxide. Following are mid-1942 prices, which were the same as the government ceiling prices established Feb. 2, 1942:

Deliveries in Eastern Territory, delivered in bags:

	Carload Lots	*Less Than Carloads*
Normal Lithopone	4.25¢ per lb.	4.50¢
Titinated	5.60¢ per lb.	5.85¢

One-fourth cent per lb. is added to the price for deliveries in Western Territory.

This product can be stored indefinitely. Substitutes are titanium pigments. The duty is 1½ cents per lb.

The text of Price Schedule 80 (Lithopone) as released by the O.P.A., said: "A sharp increase in the demand for lithopone has occurred in recent months as a result of the national defense program. Lithopone is an extremely important chemical, essential in the production of a great many products necessary to the armed forces and civilian population."

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Liver

AMONG the most valuable foods on the menu are liver, heart, kidney, and other meat specialties. Like other meats, they are rich in high-quality proteins, iron, phosphorus, and copper and in many of the B vitamins. Liver, heart, and kidney are richer in vitamin B_1 than most meats except pork; they are far richer in riboflavin, and they are among our richest food sources of vitamin A. Liver and kidney are also rich in niacin (a vitamin needed in the prevention of pellagra) and liver is even a good source of vitamin C and contains some vitamin D.

A food element often insufficiently supplied is iron. People who do not get enough iron are pale and weak. Liver, heart, and tongue are among the richest meats in iron, and as the Council on Foods and Nutrition of the American Medical Association has expressed it, "as a source of iron liver has long held a position of preeminence."

Liver may be added to soup to increase its food value.

Calf and lamb livers are most in demand, because of their tenderness, but beef and pork livers are just as wholesome and just as rich in food values. Yet in the early days of Cincinnati and other pioneer meat-packing cities, livers and hearts were thrown in the river or buried on the prairie, and not so many decades ago these meat specialties were still being given away to anyone who would carry them off.

Ground liver is fed to babies, to supply needed iron.

The knowledge and popularity of liver began to soar in 1926, following the discovery of its use in pernicious anemia, a disease formerly nearly always fatal, by Drs. George R. Minot and William P. Murphy of Harvard and Dr. George H. Whipple of the University of Rochester — for which discovery these three received the 1934 Nobel prize for the advancement of medical science. In recent

years it has been found that liver extract is far more potent than diet alone in combating the disease.

People who originally had a distaste for liver learn to like it in meat loaves or other varied recipes, or ground and taken with some favorite fruit or vegetable juice.

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Carnivorous animals and birds so often devour their victims' internal organs first that they seem to know instinctively that these parts are especially rich in food values. An exception, however, is sometimes claimed by polar explorers, who declare that polar bear liver is poisonous and that no animal will eat it.

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Lizard Skins

See Reptile Skins

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Loblolly Pine

See Southern Pine

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Long Leaf Pine

See Southern Pine

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Loofah

See Luffa

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Lucerne

See Alfalfa

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Luffa

Luffa, also called loofah, is a plant which produces a gourd-like fruit which, when deprived of its pulp, leaves a network of strong fibre. This makes it useful as a sponge for toilet and bath. Other uses are as a filter, and for soles worn inside boots, shoes and slippers. Although various species occur in tropical countries in wild state, the commercial luffa is a cultivated product of Japan, formerly the principal producer with a volume of 75 to 100 million pounds per year. Prices for luffa sponges are based primarily on the length of the piece. Because of its use in the oil filters of certain marine engines, U. S. stocks were ear-marked for Government use after the U. S. entrance to the war. With the elimination of Japan as a source, due to the war, Cuba was reported making a bid for this market in a small way.

Luffa is non-perishable. It is free of duty in crude or unmanufactured state.

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Lumber

UNDER the microscope a cross section of a piece of wood is seen to consist of separate units arranged in very close formation. These units are, for the most part, short fibrous cells, narrow tubes about as fine as a human hair, whose walls are composed mostly of still finer spirally wound strands of cellulose. They are cemented together by a substance called lignin. The arrangement is intricate in its details and varies widely among the many species of trees. It is this variation that gives to woods of different species the properties that make them suitable for different uses.

Under the climatic influences of the temperate zone, new wood growth is added to the tree trunk in annual layers, which are seen as rings in cross section. In the life processes of the tree complex chemical substances are formed that vary again among species; often they are highly colored. The varied arrangement of fibers, growth layers, and coloring materials produces the attractive patterns and figured effects that give distinctive beauty to the sawed and finished surfaces of many woods.

To manufacture the lumber into the finished product is a long and delicate process requiring many operations.

The first operation in getting out the logs from which the lumber is made is the cutting down or the "felling" of the trees. Recently developed power driven cross-cut saws are used to a limited extent, but for the most part trees are still "felled" by the woodsmen in the same way they were when the colonists cut the first trees of the new world.

The men first make a sharp cut in the trunk of the tree with an axe. The initial horizontal cut may be made with a saw and an open wedge chopped out above, but in either case it is termed the undercut and is for the purpose of guiding the fall of the tree and keeping the end of the trunk from splintering. The actual severance of the tree, which makes it fall, is done with a cross-cut saw, which is started from the side of the tree opposite the undercut, the tree falling toward the undercut.

In making the undercut and in sawing very large trees, it is often necessary to insert "springboards" into the trunk of the tree for the workmen to stand on. This is done in order to raise the place where the tree is being cut above the part of the trunk where the roots spread.

After the tree has crashed, workmen known as "swampers" and "buckers," begin their work.

The "swampers" are the men who clean the branches from the fallen trunk and the "buckers" are the men who cut the tree into standard saw-log lengths.

The logs are next moved to the skidway either by animal, steam, gasoline or Diesel power, "pull boats," chutes, or flumes, depending on the custom, locality and character of the timber.

In big timber as in the west, the logs are skidded to a landing place with a steam "donkey engine." Heavy steel cables, running upon drums operated by the engines, drag the logs from their resting places to the point where they are to be assembled for shipment to the mill.

The pull boat is used in the cypress swamps of the South. It consists of an engine with drums and cables and is mounted on a flat bottom boat. It is used to pull the cypress logs through the swamps and artificial canals in that region.

A flume may be constructed of heavy lumber where water is plentiful to float the logs to a point of assembly.

An early method of transportation, still used in some parts of the country, is that of

"driving" the logs down a stream. The logs are rolled into the water loose and carried down stream by the current. Much work is necessary to avert jams, keep the logs in the main channels, and gather up stragglers. Many logs are left in shallow places or become waterlogged and sink, thus being lost.

Similarly, on large rivers, lakes, and along the Pacific from lower Alaska even to San Francisco Bay, logs are rafted. Logs are assembled in quantity, securely bound together by chains and towed with power boats or tugs. This method gives reasonable "insurance" against loss.

Logging railroads went far to replace the driving of logs but more recently motor truck transportation was fast displacing railroads in many regions. In fact, transportation of logs by motor truck combined with partial cutting to assure seed sources made possible by the use of caterpillar tractors in the woods has increased the economic radii of many mills. This, combined with increasing effective protection against fire, has indefinitely extended the operating life of many of them. In some instances the increase has been so great as to practically perpetuate the operations. This condition is particularly prevalent in the South and in the Pacific Northwest.

With the logs cut and delivered to the mill pond, their conversion into lumber begins. This involves sawing boards or other stock of specified dimensions, edging off the bark, trimming the ends and defective portions, grading the product into standard classes, and piling it in the yard to season or await sale. In some operations this last is omitted and the lumber goes straight from the sawmill to the dry kiln to be seasoned under controlled heat and moisture conditions, and immediately shipped to market.

The objects sought in kiln drying lumber are: (1) reduction of moisture content of wood to make it suitable for a specific use; (2) prevention of deterioration of the better grades of lumber due to discoloration of the sapwood; (3) reduction of the time required to get lumber into a shipping condition, permitting a more rapid turnover of stock, and (4) reduction of shipping weight.

The larger modern mills are equipped with band saws, but many of the smaller mills use circular saws as their main sawing equipment. This is called the "head rig." Band saws produce less waste in sawdust, and the lumber is more uniform than that produced from the ordinary circular saw mills.

In addition to the "head rig," auxiliary sawing apparatus, consisting of re-saws, and gang saws, is very common. Re-saws are either upright or horizontal bandsaws of smaller gauge than the main saws, and produce lumber economically by taking the thick material from the "head rig" and cutting it to final size. Gang saws consist of a large number of short, straight saws set upright about an inch or more apart in a heavy frame which is moved rapidly up and down.

As the log comes into the mill from the "jack slip" it moves into the log deck and then to the saw carriage which carries it to the band saw. This saw cuts the log into whatever thickness of lumber is desired. These boards, planks, or other products of the saw may then be shuttled along to the gang saw or re-saw for further reduction in size, or in some mills this intermediate step may be skipped. Then they are moved to the edger, from the edger to the trimmer, to the planer, to the grading table (where a man grades each piece of lumber for quality) and then to the yard or drykiln for seasoning.

All boards which have not been cut to uniform widths with square edges by the "head rig" pass through the edgers where the board is sized or edged. In softwoods, widths are usually in multiples of 2″, but in hardwoods no attempt is made to produce

lumber of specific widths, each piece being made as wide as possible.

The trimmer is a set of circular saws placed in a common line one or two feet apart—each saw being separately attached to a moveable arm so that the operation of a lever raises it up to let a board be carried underneath without sawing. The trim sawyer decides the best method of trimming off defects, or cutting to most profitable lengths the stream of boards passing on the endless chain in front of him.

The length of time necessary for lumber to remain in the pile to reach shipping condition depends upon the thickness and character of the timber as well as the climate. In high altitudes or in arid regions, some species of inch lumber may dry out sufficiently to ship in less than two months; in humid regions near the sea-coast, a year may be necessary for the air-drying of lumber.

Merchantable saw-timber within the United States was estimated in 1938 at 1,764 billion board feet of which 1,493 billion board feet are softwood and the remainder of hardwood. One-half of the total stand, or 883 billion board feet, is within the forests of the Pacific Northwest. Most of this is old growth Douglas fir, pine, hemlock, spruce and other softwoods, while 22% is in the South. Hardwoods bulk large in the Southern stands and constitute nearly 40% of the 387 billion board feet of saw-timber growing in that region.

As of 1938, when lumber production amounted to 21,646,271,000 board feet, more than 45% came from the South, and 40% from three Pacific Coast states. That year one-third of all lumber produced was Southern Pine with Douglas fir and Ponderosa pine following to constitute 70% of all lumber produced. Hardwoods were responsible for 15% of our total production, of which one-third was cut from the several oaks. Lumber from the oaks (principally white oak and red oak) the gums and maples, poplar, birch and tupelo, with chestnut trailing, constitute most of the commercial hardwood lumber cut.

U. S. production in 1941 was estimated at 33 billion board feet.

Today there are close to 5,000 important commercial uses for wood.

The construction industries consume the most wood, but manufactured items such as radio cabinets and shipping boxes demand hard and soft lumber in enormous quantities. The films of the motion picture industry are derived from the cellulose of wood. Doors and window frames and sash are almost universally of wood as is fully 85% of all office and household furniture. Agricultural implements and a host of tools find it indispensable. All our network of steam and most of our electrical railways rest upon wood cross-ties; ports and ships cannot do without wood; few bridges dispense with it entirely.

The United States is staked out with tens of millions of telephone poles made of wood, and billions of wood fence posts. Wood is used in the manufacturing of cases, trunks, barrels, boxes, crates, handles, furniture, picture frames, signs, musical instruments, airplanes, toys, fountain pens, pencils, clothespins, sewing machines, laundry appliances, utensils, silos, gun stocks, refrigerators, gates, garden furniture, spools, textiles, forms for concrete work, building scaffolds, water conduits—in fact for anything from cradles to coffins.

The war caused lumber to be diverted from civilian construction to military uses. Lumber replaced steel in cantonments, war material warehouses and other military structures.

The marketing unit is usually 1,000 board feet. Prices vary with the different classifications and grades. Douglas fir plywood was the first variety to be placed under a ceiling (effective Aug. 5, 1941) and then

ceilings were extended to cover the other varieties.

Lumber is a bulky commodity which pays one of the nation's largest freight bills. From the west coast to the east coast either water transportation or rail transportaion is used. From the western inland areas rail transportation predominates. From the south to the north both rail and water shipments are in use. From the Mississippi Delta and other hardwood regions rail shipments predominate. In areas combining both producing and consuming regions, motor truck transportation is common.

Commercial standards of lumber can be divided into two general classes properly known as softwoods and hardwoods. These terms are frequently somewhat confusing as some softwoods, such as hard pine, are much harder than some hardwoods, such as basswood, etc. For practical purposes the terms indicate a type of wood rather than the physical characteristics of a given wood. The softwoods are sometimes known as coniferous woods because they are usually cone bearing. Another term frequently used is evergreen because the leaves usually stay on throughout the year, as for example, the spruces, hemlocks and pines. The softwoods generally have needle-like leaves.

Hardwoods are obtained from broad-leaved, non-deciduous trees, such as elm, ash, oak, and poplar. The leaves are broad except in rare instances and in the temperate zones usually fall off during the winter.

A more accurate description of hardwoods and softwoods, though technical, is that the hardwoods contain vessels whereas the softwoods do not.

Basically there are three groups of lumber grades: (1) Yard lumber, or construction grades, wherein the grades are based upon the use of the entire piece; (2) Structural material, or stress grades, which have been brought out to make grades that will provide wood members of known strength as for bridge timbers, roof trusses, floor joists, etc., and (3) Factory and shop lumber which is graded on the basis of the percentage of the area which will produce a limited number of cuttings of a specified size and quality. These grades are used principally for lumber wherein it is desirable to have pieces of relatively short length but comparatively clear, such as in the manufacture of furniture.

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Lye

See Caustic Soda

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Macaroni

MACARONI is a kind of paste composed chiefly of wheat flour and some eggs, dried in the form of slender tubes and used, when cooked, as food. Macaroni products include spaghetti and noodles, which are made in other forms of the same ingredients. Several types are manufactured, one common formula using durum wheat or spring wheat farina, rich in gluten. Other manufacturers use semolina, a granular meal made from durum wheat, an unusually hard, glutinous variety. Others use a blend of semolina and farina, with cheaper grades made from durum or hard wheat flour other than durum.

Macaroni is commonly sold by brand, rather than by grade, and the pound is the trading unit, except in the case of consumer packages, which are sold by the dozen. It is packed in 5, 10, and 20 pound boxes for bulk distribution, and in small containers ranging from 6-ounces to 1-lb. for consumers. Transparent wrappings are being increasingly used in consumer packaging.

The product requires dry storage and has a reasonably long commercial life when properly warehoused.

Competitive brands of durum wheat semolina macaroni sold, in July of 1942, from 4 to 6 cents per pound in bulk f.o.b. factories. Competitive brands of packaged of the same quality sold at 65 cents per dozen 16-ounce packages. Durum flour spaghetti sold from 3 to 5 cents per pound in bulk and about 50 cents per dozen for 16-ounce packages. On advertised brands, list prices were much higher.

Macaroni may be shipped by any of the common carrier forms. It is manufactured on a year-around basis.

Substitutes are spaghetti or noodles.

Import duty is 2 cents a pound on macaroni containing no egg or egg product and 3 cents per pound if the product contains egg or egg products.

Macaroni comes under the General Maximum Price Regulation.

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Mackerel

CONSIDERED to be of the greatest commercial importance, even from the Colonial days, is the common mackerel, which is found extensively off New England. The supply has been uniformly plentiful although there have been sporadic periods when it has dropped to low levels.

The mackerel is shaped somewhat like a cigar, tapering forward to a pointed snoot and backward to a slender caudal peduncle. It has two fins on its back, placed far apart, the space between them being longer than the base of the first fin. Behind the second dorsal fin is a series of 4 to 6 (usually 5) finlets. The anal fin similarly is followed by about the same equal number of finlets. A distinguishing character of the species are the two small keels on the caudal peduncle, one below and the other above the lateral line. The color is bluish black above, with wavy blackish transverse bars, and mostly bright silver below.

The 1940 catch of mackerel amounted to 638,761,000 pounds valued at $2,214,000. Of this catch, New England accounted for 35,970,000 pounds valued at $767,000; the Middle Atlantic, 4,070,000 pounds valued at $146,000; the Chesapeake, 591,000 pounds valued at $28,000 and the Pacific, 120,504,000 pounds, valued at $1,280,000.

The 1939 catch of mackerel amounted to 113,503,000 pounds, valued at $1,773,000. The 1939 season was one of those comparatively low seasons which accounts for the big gain in 1940.

Reports indicated that the 1942 mackerel season would be a very good one, although probably not a record one. Fewer boats were engaged in this fishery in 1942, due to the war. So many New England vessels have been taken over by the navy that it now pays for a vessel owner to keep his vessel in the ground fisheries (cod, haddock, rosefish, etc.) rather than to change over for seining mackerel.

The season opens in early June (varies from year to year but only by a few weeks at most) and extends to late November.

The fish first appear off Cape May, N. J. and the first catches bring handsome prices and the honor of being "first." The fish then run northward and are caught in great abundance off the Massachusetts and Maine coasts. In the winter no one knows where they go—they just disappear, presumably into the deep waters of the ocean way offshore.

Mackerel travel in schools and are caught with the purse seine and the gill nets. Some are caught in the fish traps along the Jersey and Long Island coasts.

The mackerel is known as the Scomber scombrus (linnaeus) or the central family of Scombridae or true mackerel. Mackerel are marketed as large, mediums, tinkers, blinks and bull's eyes. They are sold as fresh, frozen (round), as fillets, as salted, as smoked and canned.

During 1940 twenty canneries packed 1,418,956 standard cases of mackerel, equiva-

lent to 68,109,888 pounds with a value of $4,088,369. During this same period, 1940, 142,059 pounds, valued at $15,048 were sold as filleted packaged fish and 832,662 pounds, valued at $68,751, were sold as frozen packed fillets.

Mackerel are shipped from production points to markets and processors, iced in boxes and barrels, by truck and express. As packaged fillets, smoked, salted, etc. they follow much the same program as any other packaged or canned fish.

Standards for mackerel, as recognized by the New England Fish Exchange are: Large, 2¼ lbs. and over; Medium, 1½ to 2¼ lbs.; Small, 1 to 1½ lbs.; Tinker, ½ to 1 lb.; and Tack, under ½ lb.

Processed mackerel, filleted, packaged, canned, all come under the general price ceiling regulations.

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Magnesite

IN ACCEPTED industrial vernacular, the term Magnesite can refer to ore as it occurs naturally in the form of carbonate or after calcination, when it becomes Magnesium Oxide. This product is mined and also processed synthetically from seawater bittern or from Magnesia bearing brines. Principal domestic areas of production are in the States of Washington, Nevada and California. Prior to the war, from 20,000 to 60,000 tons were imported annually from Austria, Greece and India but the war stimulated sufficient expansion in domestic production to supply all needs. Total U. S. production for 1942 was estimated at 300,000 tons in calcined form. The latest available figures for world production of crude Magnesite, exclusive of the United States, was 1,147,865 metric tons for 1938.

In the order of their importance, following are the principal uses for Magnesite—Refractory grain and brick for construction and maintenance of basic open-hearth and electric furnaces; spark-proof floors and marine decking; manufacture of epsom salts; as a source of metallic magnesium; as an ingredient in heat-resisting glass, hard rubber and glue; as a coating for welding rods; to reduce the silica content of boiler feed water, and numerous other applications in the chemical industry.

Marketing is in bulk and bags with principal distribution in carload quantities. Price quotations are by the ton, ranging from $22.00 per ton at point of production for dead-burn grain to more than $100.00 per ton for specially pure grades. The above quoted price for dead-burn grain represents the ceiling imposed on Jan. 28, 1942.

Refractory grades of the calcined ore will keep for a year or longer if stored indoors. The light-burned varieties tend to absorb moisture from the air when powdered, but will keep satisfactorily up to nine months, depending upon climatic conditions. Calcined production falls into two distinct classifications, dead-burn for refractory uses and light-burn for other industries. The only possible substitute for this product might be burned dolomite for dead-burn Magnesite. The importance of Magnesite in the war effort may be attributed to the fact that Magnesite refractories are essential for the construction and maintenance of open-hearth and electrical furnaces and other products employed for actual production of war material.

Following are import duties, per ton, as established under the Tariff Act of 1930: crude, $9.37; calcined, $18.75; dead burn, $11.50.

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Magnesium

THERE has been a phenomenal growth in the production of magnesium, lightest of all structural metals, spurred on by war de-

mands and especially the requirements of the airplane industry.

Magnesium is one of the abundant elements, two-thirds the weight of aluminum, which it resembles in appearance and characteristics. Its specific gravity is 1.74; the melting point 651° C.; and boiling point 1120° C. Magnesium is one-fifth the weight of copper.

Up until 1941, production—which for that year totaled 12,521,726 pounds compared with 6,700,122 (1939)—was recovered by one company from brine pumped from underground wells in Michigan. The brine contained about 3.2 percent $MgCl_2$ (Magnesium chloride) and about 0.8 percent magnesium. The bromine and the sodium and calcium salts were removed by evaporation, filtration and fractional crystallization, chlorine being added. The purified magnesium chloride solution, after further concentration by crystallization, was partly dried. Electrolysis in rectangular steel cells of molten magnesium chloride, with sodium chloride added, was the final process used to produce the primary magnesium.

However in January 1941, at Freeport, Texas, recovery of magnesium from ordinary sea water was begun. There are an estimated nine billion pounds of this important metal in every cubic mile of sea water —an unlimited supply. Recovery from sea water, which contains 0.48 percent $MgCl_2$ (0.12 percent magnesium), is accomplished by the precipitation of magnesium hydroxide (milk of magnesia) by the addition of milk of lime—obtained by adding water to calcinated oyster shells. The magnesium hydroxide is thickened, filtered and treated with hydrochloric acid to produce magnesium chloride which is made nearly anhydrous and electrolyzed by the same process as is employed in Michigan.

The Freeport plant was but the start of an expansion program. Later in 1941, a plant was completed in California. Production and potential production have expanded rapidly.

Although most of the production has been used in military airplanes, a substantial quantity has also been employed in the manufacture of incendiary bombs, flares and other munitions. The metal, when pure, burns easily with an intense flame, giving a brilliant light. A powder of about 200 mesh is used for flash work while a mesh of 30 to 80 is usually employed for slower burning flares or rockets.

Consumption of magnesium continues to outstrip production. In 1940, United States consumption of magnesium was divided: 64 percent in the manufacture of magnesium-rich alloy structural products; 32 percent in aluminum, zinc and other alloys; and 4 percent as scavenger and deoxidizer in metallurgical works, and in pyrotechic, chemical and other uses.

Magnesium production on a large scale is so recent that there has been little time for experiments in the field of alloys with other metals, but the lightness combined with strength and resistance to wear and corrosion (it is unaffected by sea water), open up great possibilities.

Price relationships, too are important. Magnesium at 22½¢ per pound figures out $25 per cubic foot as against aluminum at 15¢, $28; copper at 12¢, $66; stainless steel at 20¢, $100; and sheet steel $10 to $15 per cubic foot.

The mid-1942 price for 98.8 percent ingot magnesium in carlots was 22½¢ per pound against 27¢ in 1940.

In 1940, the United States produced 5,680 tons and Germany an estimated 19,000 tons, out of estimated world production of 39,900 tons. Currently, the United States is believed to be producing more than the rest of the world combined.

The industry predicts great things for magnesium. It is pointed out that the use of the metal can save up to a ton in weight when employed in small truck bodies, and

two tons on the large trucks. Use in the freight car field, in typewriters, cameras, cash registers, canoes, and furniture are but a few of the promises of the future.

Magnesium's importance in the war production field is illustrated by the fact that it was the second metal upon which formal mandatory priorities were invoked. On Feb. 12, 1941, the OPM requested producers to allocate all metal to defense needs. On March 3, 1941 mandatory priorities were invoked. Finally, Order M-2-b, effective November 14, 1941 brought all magnesium—stock and production—including scrap, under control.

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Magnesium Stearate

MAGNESIUM STEARATE is a very fine white powder, exhibiting exceptional adhesive properties. It is formed by the reaction of a soluble magnesium salt, with sodium stearate. It is employed in cosmetics, as a flatting agent in varnishes and lacquers, and as a lubricant in the plastic, rubber, and other industries.

Production of magnesium stearate in 1939 amounted to 104,689 pounds, valued at $23,199. In 1937, total manufactures in the United States were 111,734 pounds, valued at $24,623. Seven plants produced the material in 1939; one more than in 1937. Commercially it is packed in boxes containing 50 and 25 pounds.

On June 1, 1942, magnesium stearate was quoted at 30 to 32¢ per pound. On January 1, 1942 the price was from 31 to 33¢ per pound; while at the start of 1941 it was from 24 to 26¢ per pound.

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Magnolia

See Hardwoods

Mahogany

A HARD tropical wood, of which many species are utilized commercially, mahogany seasons well and is valuable for all types of cabinet work. The war has brought, in addition, an increased use for plywood and parts of aircraft, boats and ships. The wood occurs in various shades of red, takes a high polish and has a remarkable range of graining.

A shortage of mahogany and Philippine mahongony brought a War Production Board order made effective May 26 (No. M-122) and amended on July 23, 1942. This regulation limited the sales and deliveries of "war-use mahogany and war-use Philippine Mahongony".

In the Western hemisphere, mahogany is cut from Mexico to as far south as northern Argentina, and imported usually in log form. The shortage of shipping space has meant that imports from Central America have been restricted to the grades best suited to military and naval uses.

Conservation Order No. M-122 defines mahogany as: "Mahogany means the wood of the several species of the genus Swietenia and the wood of the several species of the genus Khaya of the Meliaceae family." "Philippine mahongony" means the wood of the several species of the genera Shorea, Parashorea and Pentacme of the Dipterocarpaceae family, otherwise known as tanguile, red lauan, tiaong, almon, bagtikan, mayapis and white lauan.

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Maize

See Corn

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Malt

See Beer

Malt Whiskey

See Distilled Spirits

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Manganese

MANGANESE is one of the metallic elements. It generally occurs in nature as an oxide, carbonate, or silicate. The oxides pyrolusite and psilomelane are the most important forms. The first, (MnO_2) contains about 63.2% managanese when pure but usually contains small quantities of silica, lime and iron. Psilomelane (hydrated manganese oxide) is often associated with it and has 45 to 60% of metallic manganese.

Commercially, it is produced and marketed in the form of ore, generally containing about 40 to 50 percent manganese metal.

It is produced for the most part by ordinary open pit mining methods. In the case of high grade deposits, the product may be shipped as mined. If the deposits are of low grade, as are nearly all those in the United States, the raw ore must be concentrated by chemical or metallurgical processes to bring it to the required grade.

The bulk of the U. S. supply of manganese is imported, at the present time from Cuba, Brazil, India, Gold Coast and South Africa. Shipments from Russia, formerly the leading U. S. source, were interrupted by the war in 1940.

Domestic manganese ore shipments of 35 percent grade or better in 1941 totaled 76,000 long tons. Imports were estimated at more than 1,250,000 long tons. The largest percentage increase in imports during 1941 over 1940 was from Cuba, where the only large producer, Cuban-American Manganese Corporation, expanded its plant and launched a program of ore buying and engineering and financial assistance to small Cuban operators to swell their output. In the United States, government agencies have undertaken a broad campaign designed to increase greatly domestic production.

About nine-tenths of the manganese consumed in the United States is manufactured into ferromanganese and is consumed in that form in making every ton of steel. The manganese acts as a deoxidizer and desulphurizer, helping produce clean, sound steel. About 12 pounds of manganese metal are used per ton of steel. Additional quantities of manganese may be added to make special manganese alloy steels.

More manganese is coming to be used in dry cell manufacture, glass making, paint and varnish driers, fertilizer, etc. Chemical users buy the ore on the basis of the manganese dioxide content rather than the manganese content.

Manganese ore is marketed in long tons. Prices are quoted per unit of 22.4 pounds, which is one percent of a long ton.

Published prices at the present time for ore containing about 50 percent manganese range from 75 cents to 85 cents, including duty.

Manganese is transported in bulk by water or rail.

The grade of manganese ore depends upon its manganese content. Ore containing 35 percent or more manganese is sometimes referred to as ferrograde ore, but normally specifications for ferromanganese manufacture call for ore of close to 48 percent manganese or better. Objectionable impurities are phosphorus, the base metals, and excessive amounts of silica, alumina and iron.

No satisfactory commercial substitute for manganese in steel making has been developed.

A duty of 11.2 cents per unit is levied on imported ore with the exception of shipments from Cuba, which are, by the Platt Amendment of 1906, exempted from the tariff.

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Mangrove Bark

See Catechu

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Manila Hemp

PRIOR to Pearl Harbor, over 90 percent of the world's supply of hemp was produced in the Philippines. Attempts to plant the fibre elsewhere had proven fruitless except for moderate successes in Borneo, Sumatra and Panama.

With the stoppage of imports from the Far East, occasioned by the war, efforts to stimulate new production sources have been intensified. A project to plant 20,000 acres of hemp in Costa Rica was announced early in 1942. It was believed that a moderate amount of hemp could be produced in about two years although it would fall considerably short of supplying all of the nation's requirements.

Manila Hemp is grown in greater or smaller quantities throughout most of the Philippines, the area of which extends from North to South about 600 miles. In the province of Davao on the Island of Mindanao (the southernmost large island of the Philippine Archipelago) the production is on what might be called a "plantation" basis. In the rest of the Philippine producing sections, the great bulk of the hemp is produced on small land holdings, interspersed here and there by hemp farms which rise to the dignity of plantations.

The production of Manila Hemp in the Philippine Islands is not noticeably affected by minor weather conditions. Drought, which affects a large area of the hemp producing provinces, importantly cuts down production when it occurs. Fortunately, however, this is not often; the last drought having been in 1912. Occasional typhoons blow down many of the growing trees but, as a rule, the typhoons are localized. Occasionally, however, there is one which covers a wide area. The production as a rule is very regular. It varies slightly in the different provinces according to the other employment offerings, the price of hemp, etc. Another interesting feature about production is the apparent ability of production to adjust itself to the demand. Production dropped when demand fell off during the depression years of 1921 to 1932 and increased to meet the 1929 peak demand.

The Manila Hemp tree closely resembles the banana tree. The tree is cut down near the ground and the leaves are cut off. That part of the trunk of the tree which contains the fibre consists of sheaths superimposed one upon the other. These sheaths are "cleaned," or decorticated, chiefly by what is known as "hand stripping"; that is to say, a method whereby the worker pulls the sheath over a long steel knife with serrations, or teeth, the number of which to the inch result in the fineness of the fibre. For example, a knife with many serrations to the inch will produce fibre of excellent cleaning; that is to say, a finer fibre. The finest fibre is produced by a "clear" knife, i.e. one with an un-serrated blade. The fineness of the fibre is due to the extent to which the adhering vegetable fibre in the sheath has been removed, and as this vegetable matters contains a certain amount of discoloring acid, the fine fibres are usually excellent color, with the exception of S2 and S3, which are almost invariably produced from the sheaths which are on the outside of the trunk of the tree and which, therefore, have been discolored more or less by the action of the sun.

About 1,400,000 bales were shipped from the Philippines Islands annually prior to the war with Japan. This represented about 80 per cent of the total production. United States imports prior to the war were as follows:

1937	363,000 bales
1938	246,000 bales
1939	403,000 bales
1940	428,000 bales

The principal, in fact almost the sole, use

of Manila Hemp was for the manufacture of rope. Occasionally it was used for the manufacture of binder twine or high grade paper, but these uses were rare and intermittent. The by-product grades, however, were used almost entirely for the manufacture of paper.

The principal use of Manila Rope is in the merchant marine, harbor boats, small boats, etc. It is also used for certain purposes in farming, building, and railroad work. Formerly there was a very large consumption for oil well cables, but these in recent years have been made of wire rope with a short length of Manila Rope attached to give the cable elasticity.

The largest use for Manila Rope is on ships and boats because of its ability to withstand the effects of salt and fresh water. Since the outbreak of war uses have been restricted mainly to military purposes.

Prices are quoted in cents per pound.

On August 29, 1941, the Office of Production Management issued General Preference Order M-36 to conserve the supply and direct the distribution of Manila Fibre and Manila Cordage, and a few weeks later the Defense Supplies Corporation became the sole world buyer for this fibre. No official price ceilings were set, but the Defense Supplies Corporation refused to accept offers of Manila Hemp at over certain prices for the various grades and this in effect completely controlled the price structure. The prices at which the Defense Supplies Corporation bought were on the basis of $11\frac{3}{8}$¢ for Davao I, $11\frac{1}{4}$¢ for Davao J1 and $9\frac{1}{2}$¢ for Davao G. The ordinary grades of Malina Hemp were purchased on the basis of $10\frac{1}{4}$¢ for grade I, $8\frac{3}{8}$¢ for grade J1 and $5\frac{3}{4}$¢ for grade K.

There are approximately 20 grades of Manila Hemp and the classification depends upon various factors, such as color, strength, degree of cleaning and texture of the fibre. Experts in the various grading establishments select and classify the fibre and pack it in bales weighing between 270 and 280 pounds. It is then passed upon by a Government Inspector. The standard of grades of Manila Hemp was set by the Department of Agriculture of the Philippine Islands and are designated as follows:—

AB, CD, E, F, I, S2, J1, S3, G, H, J2, K, L1, L2, M1, M2, DL and DM.

In addition there are grades known as O (Strings), T (Tow), Y (Damaged), and W (Waste), which, however, are in the nature of by-products of the good fibre.

Certain groups of grades are known by the degree of cleaning: for example,

AB, CD, E, F, S2. and S3	are excellent cleaning
I, J1, G, and H	are good cleaning
J2, K, and M1	are fair cleaning
L1, L2, and M2	are coarse cleaning
DL and DM	are very coarse cleaning

The chief substitutes for hemp are the Sisal and Henequen fibres. As regards duty, Manila Hemp has been on the free list since shortly after the Civil War.

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Manure Salts

See Potash

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Maple

See Hardwoods

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Maple Syrup

PRODUCTION of maple syrup in the United States rose sharply in 1942 — from 1,997,000 gallons to 2,902,000 gallons—as a result of sugar rationing. Domestic disappearance is estimated at 3,202,000 gallons, the balance we use coming in from Canada.

A gallon of syrup which weighs about 11 pounds is figured to contain the equivalent of 8 pounds of sugar.

Vermont is the leading producer of maple

syrup with New York a close second and Ohio rated the only other important producing state, although Pennsylvania and Michigan produce over 100,000 gallons each in a normal season.

The peak production of syrup was 4,141,000 gallons in 1918 while a more recent top output was 3,377,000 gallons, in 1935.

The price of syrup has risen sharply with the shortage of other sugars. From 1937 through 1940, prices held within a range of $1.60 to $1.68 per gallon.

In the period, 1929-38 the average number of trees tapped in the United States for the production of maple sugar and maple syrup was 12,208,000. In 1942, to reach the expanded total of output it is expected that a larger number of maples will be utilized.

In July of 1942, maple syrup was priced at about $3.25 per gallon, in six gallon cans.

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Maple Sugar

THE United States produced 657,000 pounds of maple sugar in 1942, against but 387,000 pounds in 1941 while consumption was expected to reach 5,657,000 pounds in 1942 against 5,015,000 pounds in 1941. The imported sugar entering the nation's consumption came from Canada.

Production of maple sugar reached a high point of 11,383,000 pounds in 1918 but fell off sharply in the years that followed. Vermont is now the leading producing state (268,000 pounds in 1940) with New York a close second (212,000 pounds).

Maple sugar had averaged about 30 cents per pound for a long period but with the advent of rationing of cane and beet sugar, and the increased demand for substitute sugars, its price rose abruptly.

Over ten million sugar maples are tapped annually in the United States for maple sugar and syrup. Counting the sugar content of the syrup made, each tree yields on the average about two pounds of sugar.

In mid-1942, maple sugar in one-pound cakes were priced at $5.25 per dozen, or about 43¢ per pound. (See Maple Syrup).

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Marble

LIMESTONE which has more or less crystallized and will take a high polish is commercial marble. Although there are some pure white varieties, as the famous Carrara marble of Italy, the majority are variegated due to slight amounts of other minerals and organic matter—such as manganese and aluminum. A cubic foot of marble weighs about 170 pounds and will withstand a temperature of up to 1200° F. In the United States, Vermont is the chief producer of a typically white marble while abroad Uruguay is a well-known source of a number of varieties.

Exemplifying the use of marble in the United States, is the beautiful Singing Tower in Florida, in which all the sculptural work is of Georgia marble. The veining is richly colored and the surface of diamond-like hardness that enabled the carver's chisel to produce sharp, clear-cut drawing. Where the carving is extremely delicate, its translucent effects are beautiful.

In 1940 United States producers sold 239,730 short tons of marble, valued at $5,196,124. Of this total, 89,040 tons were sold as "dimension stone"; 782,600 cubic feet as building stone at an average value of $4.25 per cubic foot; and, 269,870 cubic feet as monumental stone at an average value of $5.45 per cubic foot. These sales were 28 per cent below 1939, in point of quantity. Vermont was the leading state with sales of 26,210 tons, followed by Tennessee, Georgia and Missouri to mention the other important sources.

Sales of crushed and broken marble by United States producers in 1940 totaled

150,690 tons, valued at $401,021. Tennessee was the principal producing state, followed by Georgia, New York, Missouri, Texas, Utah and Massachusetts in the order named.

Marble producers accumulate large quantities of waste material, consisting of either defective blocks or of cuttings and spells that result from marble dressing, and they are constantly seeking profitable outlets for this waste. The price per ton realized varies greatly, because some states produce relatively high priced products, such as terrazzo, stucco, and marble flour, that may be worth several dollars per ton, whereas other states find outlets only in the form of riprap, road stone, and concrete aggregate that may command prices of $1 or less per ton.

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Margarine

MARGARINE is a pearly white tablefat, with a plastic semi-solid consistency and the palatable flavor and aroma resulting from the ripening of milk. Practically no margarine is colored by the manufacturer in this country because of prohibitively high taxes on the colored product. A 10-cent-per-pound federal excise tax is imposed on colored margarine as compared with ¼-cent on the uncolored product. There is a $480 federal wholesale license tax on colored margarine, as compared with only $200 for wholesalers of uncolored margarine, and a $48 federal retail license fee for selling colored margarine as against $6.00 for retailers of uncolored. In addition, some states tax colored margarine (as well as the uncolored), while other states prohibit the sale of colored margarine entirely. A color wafer contained in each package makes it a simple matter for the housewife to color margarine in her own kitchen.

Margarine is made of one or more well-known food fats or oils and pasteurized skim milk, together with salt, certain emulsifying agents, and Vitamin A. Cottonseed oil leads all other fats and oils as an ingredient of margarine in the United States. There are also large quantities of soybean oil, oleo oil, and neutral lard used in this product, and lesser amounts of peanut oil and corn oil. Until very recently, babassu oil, coconut oil, and palm oil have also been ingredients of margarine, but the War Production Board has now prohibited the use of these oils in margarine, shortening, and cooking fats.

Margarine in this country is manufactured principally in Chicago, Los Angeles, San Francisco, Kansas City (Kansas), and Bayonne, New Jersey, but there are plants located also in Alabama, Delaware, Georgia, Indiana, Maryland, Michigan, Minnesota, Missouri, Ohio, South Carolina, Texas, and Jersey City, New Jersey. Almost no margarine has ever been imported. The total United States annual production of margarine is slightly under 400 million pounds.

It is used as a tablefat, and for seasoning in cooking, for baking, and for pan frying. However, its primary use is as a spread for bread, and it is therefore an alternate for butter; but costing about half as much as butter, or less, margarine is sold principally to the consumer who cannot afford to buy butter.

The manufacturer sells margarine to the distributor, and, in turn, the distributor sells it to the retailer, in one-pound and two-pound cartons, which are packed in 12-pound, 18-pound, 24-pound, and 36-pound cases. The retailer sells the product to the consumer in the one and two-pound units. To the baker and restaurant trade, margarine is sold in tubs containing 25 pounds or more.

The price of margarine is quoted in the trade in cents per pound, F.O.B. Chicago.

The average price quoted for April 29, 1942, for white domestic vegetable margarine was 19 cents per pound, compared with 14.5 cents during April, 1941; white animal

fat margarine was quoted on April 29, 1942 at 15 cents per pound, compared with 13 cents during April, 1941. Until the national price ceiling was proclaimed at the end of April, 1942, there were no price ceilings on margarine, although there were ceilings on its principal ingredients. The over-all price ceiling provided for the freezing of prices on the March, 1942 level. During March, domestic vegetable margarine at Chicago was quoted at 19 cents per pound, white animal fat margarine at 15 cents per pound, and the average retail price at 22 cents per pound.

Margarine, like butter, is a perishable product. The length of time any margarine would remain merchantable depends on the ingredients used in its manufacture, the storage conditions, method of packaging, and other like factors. The principal types of margarine used by the consumer are the white domestic vegetable and the white animal fat margarines. (For table use, the consumer usually colors these in her own home.) So-called animal fat margarines are never made entirely of animal fats, but are in reality a combination of animal fats and vegetable oils. The baking industry uses the margarines known as puff paste. Puff paste is not what is commonly known to the consumer as margarine, which is primarily a table product; but since puff paste comes within the Federal definition of oleomargarine, it must be considered legally a margarine.

There are no fixed price differentials for the various grades and types of margarine. The differentials are not subject to rapid change since there is a tendency to hold prices of one grade at the same level for several months.

There is really no adequate substitute for margarine on the same price level. Butter, peanut butter, and other palatable and nutritious food fats may be used respectively for the same purposes as margarine. But the high price of butter places it out of reach of many low-income consumers, so that when we consider quality in relation to price, butter cannot serve as a substitute for margarine. Again, in substitution, care must be taken to insure that the Vitamin A content of the daily diet is sufficient. Margarine when enriched with Vitamin A—and most brands are now so fortified—must contain at least 9000 units per pound, which is the average Vitamin A content of butter. If peanut butter were used to replace margarine in the diet, additional amounts of Vitamin A would have to be obtained from other sources.

Two taxes are levied upon margarine imported into the United States: a tariff duty of 14 cents per pound, and 15 cents a pound for an internal revenue stamp which is affixed to each package sold in this country. But, as already indicated, imports of margarine have always been negligible.

There is a federal excise tax on margarine manufactured in the United States—¼-cent a pound on the uncolored product and 10 cents a pound on the colored. State excise taxes on margarine are many and exert an extremely restrictive, and in many instances, prohibitive effect on its distribution and sale. Soon after the introduction of margarine to this country, in the early 1870's, both federal and state taxes and regulatory laws began to be applied to the manufacture and distribution of the product. The dairy interests have contended that margarine competes with butter.

The federal law provides also for annual license fees of $600 for manufacturers of margarine, $480 for wholesalers of colored margarine, $200 for wholesalers of uncolored margarine, $48 for retailers of colored margarine, and $6 for retailers of uncolored margarine.

Before the first federal margarine law was adopted in 1886, over one-half of the states had already enacted margarine laws,

many of which were later declared unconstitutional. During the last seventeen years, state legislation directed against margarine has been revived. In 1929, a series of state excise taxes on margarine began with the placing of a five-cent-per-pound tax on uncolored margarine in the State of Utah. Eight states have excise taxes on all uncolored margarine: Idaho, Iowa, and Utah, with a levy of 5 cents per pound, Oklahoma and North and South Dakota, with 10 cents per pound, and Washington and Wisconsin with the extremely prohibitive rate of 15 cents per pound. Eighteen states have either excise taxes or yearly license fees on the manufacturers, wholesalers, and retailers of all types of margarine. Montana and Pennsylvania have the highest license tax requirements, the former requiring from the retail grocer $400 a year, the latter $100 a year. In these states the sale of margarine has been seriously curtailed. And in states levying as high an excise tax as 10 or 15 cents per pound, the effect has been to destroy the sale of margarine completely.

Margarine, along with other food products, is regulated by federal, state, and municipal Pure Food and Drug Laws, and has been for many years. Furthermore, the Federal Standard for Oleomargarine, which went into effect during September, 1941, defines the essential ingredients of margarine (which by federal law must be labeled "oleomargarine," in reality a misnomer) and requires unmistakable labeling.

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Meats

FEW INDUSTRIES in the United States play such an important role in the economic welfare of the country as does the live stock and meat industry. Meat packing ranks third among all industries in value of finished product, and five times in the last eleven Census of Manufactures (biennial) years, the value of the product of the meat packing industry exceeded that of any other American industry; in fact meat packing has ranked either first or second in every Census year except two since 1919.

In addition, half the farm land of the United States, a large majority of its farmers, and a considerable fraction of its food processors and distributors are partly or wholly engaged in supplying the country's meat. Half of all the farm land is devoted to pastures for live stock and millions of other acres are utilized for growing hay, corn, and other crops primarily utilized as live stock feeds.

Live stock constitutes a chief source of income to the American farmer, nearly 30 per cent of his cash income being derived from meat animals alone. Nearly one-sixth of the people engaged in manufacturing foods are meat packing plant employees, and about 300,000 persons sell meat at retail. Transportation agencies, stock yards and commission men, and those who furnish supplies of various kinds are just a few of the others who depend at least partly upon the live stock and meat industry.

Although the greatest amount of meat is consumed in the thickly populated sections of the East, by far the greatest numbers of live stock are raised in the West and Middle West; consequently, there is a constant movement of meat, lard, and other products of the industry eastward. States west of the Mississippi River grow about five-eighths of the live stock and eat hardly one-third of the meat produced; the eleven states north and east of Washington, D. C., with one-third of the meat consumers, grow only about one-twentieth of the live stock. The Corn Belt region of the Mississippi valley and the range lands of Texas and the West are the most important live stock growing sections.

Because of the abundance of grains and

other feed crops in this country, practically all animals marketed are produced within our own borders. After they have been made ready for market, they cannot be held for any apreciable length of time without considerable expense. For this reason and because of certain factors involved in the growing of stock, the business of the live stock producer is largely seasonal.

For example, cattle which have been given feed and shelter during the winter and spring months are marketed in larger numbers during the spring period because of the pressure of farm work during that time, the approach of hot summer weather, and the arrival of the fly season. On the other hand, other grades of cattle often are placed on grass for the summer and are marketed somewhat later.

The largest marketings of hogs are in December and January because of the greater economies in producing for the fall and winter markets. Pigs farrowed in the spring miss the winter weather and fewer losses from death occur. In addition, they can run on pasture during the growing period when the greatest gains are made. There is a secondary peak in June, however, pigs farrowed in the fall being ready for the market at that time. Receipts usually are lowest in August and September. From June through September in some markets, more than a fourth of the hog receipts, and occasionally even half of them, consist of sows that farrowed in the spring and then were fattened for market.

There are generally two periods of heavy lamb marketing. During May and June, native lambs weaned fat are shipped, and in August, September, and October range lambs appear.

Certain other factors may intervene to disrupt the ordinary marketing season, but over a period of time, most of them have little effect. Probably of greatest importance is the market value of corn and other grains in relation to the value of live stock. For example, it takes ten bushels of corn to add 100 pounds to the live weight of a hog, and, when corn rises abnormally, many farmers send their hogs to market early; but when the corn can be utilized more profitably as feed, hogs are marketed during the usual seasons.

Like raw materials used in other industries, live stock are of various kinds and grades, and because of the wide range in quality, condition, and kind, inclusion in a relatively few grades is difficult. The industry has, however, established fairly definite grades and a common language between buyer and seller makes it possible for each to determine accurately the value of an animal of a certain description. And, since live stock are bought on inspection, the slight variation within any particular grade is relatively unimportant.

The United States Department of Agriculture, Bureau of Agricultural Economics, has worked out standard grades for cattle, and correspondingly for dressed meats. These grades, and the value of any animal, depend upon the quality, conformation, and degree of finish.

Live stock is classified according to sex and grades are set up within each classification. For example, the grades of steers in order of quality are prime, choice, good, medium, common, cutter, and lower cutter. Hogs are graded prime, choice, good, medium, common and cull, and are also classified as butcher and bacon, according to whether the animal is a lard type or bacon type hog.

Three general marketing channels are open to the producer; through public markets, by direct sale or shipment to the processor, and through auction sales. The greatest volume is handled by central public markets, but many farmers prefer to sell their hogs direct. Direct selling provides an outlet for a sizable proportion of the country's

hog production; fewer cattle, calves, and sheep are marketed by this method.

Scattered throughout the 48 states are 66 public markets where live stock is sold daily. Eleven of these markets usually receive more than half of the hogs marketed at all public stock yards; they provide the data on daily live stock receipts that are published by the United States Department of Agriculture. These public markets are live stock trading centers where facilities are provided for receiving, caring for, and handling live stock. Anyone who wishes to do so may buy and sell at a public market. At all such markets, there are various agencies whose services are available to the shipper; these include stock yard companies, commission firms, and live stock exchanges.

Stock yard companies, in brief, operate hotels for live stock. They lease the facilities of public markets, but do not engage in buying and selling live stock. Their functions are to receive shipments, provide pens, feed and water the stock, weigh it when sold, and render other services incidentally.

Commission firms sell stock received on consignment, and buy on order. Their remittances are sent to consignors after deductions for freight, yardage, feed, insurance, commissions, etc. Also they keep patrons informed regarding market conditions.

Other buyers on the market are order buyers and yard traders. Order buyers are brokers who buy on order for shipment to meat packers and others. Yard traders buy in anticipation of profitable resale at the point of purchase or at other markets. They generally purchase small, mixed, and odd lots and re-sort in more uniform lots.

Live stock exchanges include commission men, order buyers, and traders. The exchange formulates rules to govern its members and determines the basis for uniform commissions, subject to approval of the Secretary of Agriculture. It also arbitrates disputes, and maintains official traffic bureaus to handle rate and claim cases for members and clients of members. In addition to members of live stock exchanges there are other commission companies, not members of the exchanges, such as cooperatives, on most markets.

When stock is received at a public market, the consignee puts it in shape for sale by allowing time for rest, giving access to feed and water, and sorting into market groups attractive to buyers.

The various buyers meet salesmen at pens, appraise the animals offered for sale, learn the prices asked and make bids. Usually after some dickering, the stock is sold at the best price obtainable. However, at some of the smaller markets sales may not be made until the trend of prices at larger markets is learned. All stock received in one day is sold during that day for the best price that it will bring from the various buyers—meat packers, traders, order buyers, and those interested in buying stockers for building herds and feeders for finishing.

In the case of direct selling, hogs may either be received at packing plants at predetermined prices, priced upon arrival, bought in the country by salaried representatives, purchased from private dealers or trucker buyers, or purchased through concentration yards. Interior meat packers, those closest to sources of supply, were the first to buy hogs direct in large numbers. National concerns soon offered similar service to producers in order to insure themselves of obtaining an adequate supply of hogs.

Concentration points are really private stockyards where stock is assembled for reshipment. Many were originally built and leased by railroads. Today they may be owned and operated by meat packers, buyers, and other private interests.

Auction markets are usually developed by local groups—cooperatives and private

interests. They vary in size and importance from small markets that provide only a few pens to those that have elaborate up-to-date facilities.

Live stock is sold by three different methods at auction sales. It may be sold by the head, by the pound with each producer keeping his stock in a separate lot, or by the pound in grouped lots. An advantage in keeping each producer's stock separate is that he can bid on it himself if the price is not satisfactory to him.

Efficient buying of live stock is of great importance in the profitable operation of a meat packing plant, for margins of profit are so low that if buyers overestimate what stock is worth, their company will lose money on their purchases; if their prices are too low, they will not be able to obtain enough stock to keep the plant running efficiently. Consumer demand for the products obtained is the factor most important in determining live stock prices, and since a large percentage of live weight cannot be converted into meat or other edible products, the demand for by-products, which number about 140, also has an important bearing.

Although there are important marketing centers in all parts of the country, it is difficult to judge whether one market is more important than another, since no two receive the various classes of live stock in the same proportion. Chicago has undisputed right to first place, and Kansas City, Omaha, East St. Louis, and South St. Paul are approximately tied. Other very important markets are Fort Worth, Sioux City, Denver, Oklahoma City, St. Joseph, Indianapolis, Pittsburgh, Jersey City, and Cincinnati. Those cities that have developed as railroad centers and that are not too distant from sources of supply while being fairly close to population centers have grown most rapidly as live stock markets. The use of trucks for transporting live stock to plants close to sources of supply has become increasingly important.

The most important products resulting from processing of live stock are fresh meat and cured meat. Fresh meat, of course, must be kept under constant refrigeration and even then must be sold within a few days after the animal is dressed. Cured meats, such as ham, bacon, or shoulder, corned or dried beef, and many types of sausage, are not so perishable and make it possible to move meat into channels of consumption a little more slowly after the peak marketing seasons crowd large numbers of live stock to market within a short time.

One important group of products includes manufactured meats, such as meat loaves and other ready-to-serve meats and sausages.

The so-called "fancy meats," such as liver, heart, brains, sweetbreads, etc., which were once discarded or given away, now provide an important source of revenue, and lard, which may account for as much as 17 per cent of the hog's live weight, is a very important factor in determining the market value of hogs.

Even with the great variety of edible products resulting from the processing of live stock about 40 per cent of a steer, 50 per cent of a sheep, and 25 per cent of a hog must be marketed in the form of by-products or lost entirely. Consequently, the development of by-products has now grown into a science. A number of the American meat packing companies carry out all of the processes of manufacture for some of the by-products, but generally the parts are processed and sold to become the raw material for the highly specialized trades that their use has called into existence.

A few of the many by-products are: leather, wool, glue, hair for brushes, violin strings, soap, dog food, live stock and poultry feeds, and farm and garden fertilizers. Pharmaceutical preparations made from by-products of the meat industry include pepsin, used in remedies for dyspepsia;

liver extract and red bone marrow, of great value in the treatment of anemia; adrenalin, used to prevent hemorrhage; kephalin, which clots blood; lecithin, used to counteract snake pioson; pituitary and pineal substances; and many others.

Illinois ranks first among the meat packing states, the value of such products coming from its plants amounting to about 18 per cent of the total. The next ten states in the order of their latest (1939) rank are: Iowa, Minnesota, California, New York, Kansas, Ohio, Nebraska, Missouri, Pennsylvania, and Texas.

In the 1939 Census of Manufactures each of these states except Texas had produced more than $100,000,000 worth of packing-house product. Indiana, Wisconsin, New Jersey, and Michigan also had produced more than $50,000,000 each; South Dakota, Massachusetts, Maryland, Colorado, Oklahoma, Tennessee, and Washington more than $25,000,000; and Georgia, Kentucky, Oregon, Virginia, and Alabama more than $10,000,000.

In 1939, on a product-value basis, meat packing was the leading industry in Illinois, Iowa, Minnesota, Kansas, Nebraska, Missouri, South Dakota, Colorado, Kentucky, and Nevada. It was the second industry in Texas, Maryland, Oklahoma, Tennessee, Utah, and Arizona; the third in California, Wisconsin, and Georgia; the fourth in Ohio, Indiana, and Idaho; and the fifth in New Jersey, Michigan, Washington, Montana, and Wyoming. It was Pennsylvania's sixth industry and New York's eighth.

The state with the largest number of meat packing establishments, however, was—Ohio! Ohio had 158, California 129, Pennsylvania 128, New York 86, and Illinois only 82. All but four states had at least four plants each.

The amount of meat and lard exported from the United States usually has virtually no effect on the supply available for domestic consumption in normal times. The war, however, has resulted in huge exports of meat products for lend-lease purposes.

Highly efficient methods of distribution have been developed by the industry. The independent wholesaler handles a considerable quantity of meat, but the greatest percentage is distributed direct to the retailer from the meat packing company through branch houses and car routes. Branch houses, located in thickly populated sections, keep enough meat on hand to supply the needs of local retailers, who may go into the coolers and select the carcasses or cuts they want. Car routes are established to serve towns where it would be uneconomical to maintain branch houses. Each car route salesman has a central point from which he operates. He makes a certain number of calls each week in the various towns, and the orders he receives are sent out by refrigerated car or truck.

The American Meat Institute is the trade, educational, and research association of the American meat packing industry. Its membership is composed of about 400 meat packing companies and sausage manufacturers, both large and small.

At present, the Institute is conducting an extensive, long-range advertising and merchandising program to tell consumers the facts about meat's place in the diet. Scientific research has established that meat is a prime source of proteins and that it provides essential minerals and vitamins. Through magazine and newspaper advertising and through point-of-sale merchandising, new and helpful information regarding meat's nutritive value is being brought to public attention. In addition, particular effort is being made to acquaint the housewife with the thrifty cuts, which are just as nutritious as those in greatest demand, and to show her how she can prepare meat in new and appetizing ways.

The Institute is also playing an important part in the war program by cooperating with

Government agencies engaged in buying food supplies for men in training. Consultations have been held between Government representatives and executives of the meat packing industry so that Govrnment meat requirements may be obtained in the most efficient manner, The Institute also has rendered assistance in the determination of standards and specifications for Government purchases. Public invitation is made to submit bids on all Government purchases and those meat packing companies that are in a position to meet Federal specifications may bid.

The Bureau of Animal Industry inspects both meat animals and carcasses in order to safeguard the wholesomeness of the meat. All live stock entering public markets must pass an inspector, and any animal suspected of disease is removed, quarantined, and disposed of under special supervision. At inspected plants live animals pass another inspection, and during dressing an examination is made of internal organs. All carcasses from healthy animals are stamped with the Government seal of approval, together with the number of the meat packing establishment.

About three-fourths of the meat packer's income from live stock products is paid out for the live stock he buys, and profits in the industry amount to less than one cent per pound of the finished product. Thus, the high degree of organization within the industry makes it possible to provide wholesome, nutritious meat and meat food products to every locality in the country at a profit so small that it has no appreciable effect on the cost of the meat that millions of families enjoy on their tables every day.

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Meerschaum

Turkey is the world's source of meerschaum, a hydrous magnesium silicate, which is white, soft and clay-like. When in a dry mass, it will be supported by water. No meerschaum has been produced in the United States since 1914 when a mine in New Mexico ceased to be worked. Promising deposits in the State of Washington have been reported by the Bureau of Mines.

In 1940, United States imports of meerschaum exceeded the total for the preceding three years, amounting to 18,431 pounds valued at $18,804. The average import value dropped to a new low of $1.02 per pound against a previous low of $1.24 in 1924.

The mineral is used almost exclusively in the manufacture of pipes and other smokers' articles.

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Melamine

See Plastics

★ ★ ★

Menominees

See Whitefish

★ ★ ★

Mercury

See Quicksilver

★ ★ ★

Mercury Chlorides

Two types of mercury chloride are produced and employed. When the term mercury chloride is used unqualified, it generally refers to the mercurous chloride, or calomel. This is an insoluble white crystalline, or crystalline-powder material manufactured by subliming common salt with mercurous sulfate. The United States Pharmacopeial grade of calomel contains at least 99.6 per cent of mercurous chloride, calculated on a dry basis.

The second mercury chloride is mercuric chloride, or corrosive sublimate. This intensely poisonous substance is usually a

white powder obtained by subliming mercuric sulfate with salt. It is also produced in granular and crystalline form. The U.S.P. specifies that corrosive sublimate must contain 99.5 per cent of mercuric chloride, calculated on a dry basis. It is used in medicine; and industrially in the production of other mercury compounds, in leather tanning, textile printing, lithography, photography, and as a preservative for organic matter. Calomel is used chiefly in medicine, as a cathartic.

The total production of mercury chlorides in the United States during 1939 amounted to 643,253 pounds, valued at $859,249. In 1937, 520,216 pounds, with a value of $603,-574 were manufactured. Commercially the mercury chlorides are packed in kegs containing 250 and 100 pounds; in 25-pound boxes; and in boxes and bottles holding one and 5-pounds.

The price of corrosive sublimate on June 1, 1942 was $2.25 per pound, which price was also in effect on the first of the year. On January 1, 1941, corrosive sublimate was quoted at $2.05 per pound. Calomel, on June 1, 1942 and January 1, 1942 was priced at $2.95 per pound; while at the start of 1941 it was quoted at $2.70 per pound.

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Methyl-Benzene

See Toluol

★ ★ ★

Methyl-Methacrylate

See Acrylic Resins

★ ★ ★

Methylsalicylate

See Wintergreen Oil

Mica

MICA, during recent years, has become an essential material in the manufacture of radios, high-compression airplane engines, and electric locomotives, as well as in a large number of well-known household appliances. In fact, but for the existence of mica, some discoveries in the uses of electricity would have been almost impossible. Known originally as Muscovy glass, the term mica covers a group of minerals with monoclinic crystals which break off into thin, tough scales varying in color from colorless to black. Muscovite is the common variety of mica and is Potash silicate. Magnesium mica, known as Phlogopite, is distinguished by its decomposition in sulphuric acid. The latter is also known as Amber mica, comes from Canada and Madagascar mostly, and is superior in heat resistance.

The colorless muscovite used for doors in stoves is the common isinglass. The specific gravity of mica ranges from 2.7 to 3.1 with a hardness of from 2 to 3. Ruby mica, from India, is the grade used mostly for condenser use. Mica is marketed as cut or uncut block, sheet, splittings, and ground. The value is usually established by the size of clear flat sheets. Splittings are usually only 0.001 inch in thickness and a few inches in diameter but are built up and held together by an insulating cement, usually shellac. The development of built-up mica has permitted the adoption of standard designs for generators and motors. The property of mica which makes it so indispensable in electrical work is that it can be divided into thin, flexible transparent films which are unaffected by fire, water, electricity, or acid, and whose volume remains constant in extreme heat or cold. There is yet no satisfactory substitute for mica, although experiments have gone forward to uncover substitutes with the same characteristics.

India is by far the largest producer of

mica. Out of a total world production of sheet and splittings of approximately 9,016 short tons in 1938, India supplied 6,334, Madagascar 747, the United States 469, Canada 68, and Brazil 575. India has also been the principal source of splittings and of radio and spark plug mica block and sheet. Madagascar is practically the only other country producing splittings in important quantities.

The apparent United States consumption of sheet mica in 1940 exceeded all previous records, being almost 44 percent higher than in 1939. The built-up-mica industry was working at capacity. It is difficult to distinguish military use of mica but a substantial part of the increased consumption of high-grade sheet mica and much of that of splittings was for use directly in airplanes, tanks and other military equipment.

Unmanufactured mica is marketed in an astonishing variety of qualities and sizes that range in price from a cent a pound for small or imperfect crystals to more than $20 per pound for large, clear, flat sheets. By far the largest proportion of the tonnage of mica used in the United States is classed as scrap, which is the raw material for making both wet-ground and dry-ground mica. This type of product includes byproduct mica recovered in washing kaolin or kyanite, as well as an increasing quantity of mica produced from schists. Although substantial tonnage and scrap mica have been imported from India, such mica is not classed as strategic because it can be replaced domestically on short notice.

In respect to the quantities of mica used for such highly important items as radio-transmitter condensers or high-tension magneto condensers, which are indispensable to the functioning of our armed forces, the United States has depended heretofore almost entirely on British India. Only a fraction of the mica produced in that country is of sufficiently high grade. However, South American mica has begun to find a compromise application for the exacting requirements of high-grade condensers. British India dominates the field of muscovite splittings not so much because of abundant supplies but mostly because of available experienced, low-cost labor. Production of sheet mica in the United States, especially by feldspar miners in North Carolina, boomed in 1940 when inactive mines were reopened. Main increases in production was of punch and circle mica—the output of which rose to 1,405,305 pounds in 1940—best since 1929 and more than double the 1939 production of 665,755 pounds. The output of larger sizes of sheet mica rose from 147,953 pounds in 1939, to 220,132 pounds in 1940. Total sales of sheet mica by domestic producers were 1,625,437 pounds in 1940 against 813,708 pounds in 1939.

Consumption of mica splittings increased to 4,918,861 pounds in 1940 from 3,423,044 pounds in 1939, exceeding the previous record consumption of 1937. Since the middle of 1940, more attention has been given to producing splittings from domestic and South American mica. The domestic product does not seem to split quite as readily and, although American workers are paid many times the rate for coolie labor in the Far East, they are not temperamentally suited to the work.

Rates of duty on mica range from 10 percent (on the untrimmed phlogopite) to 45 percent on films cut to dimension. Thin splittings, the largest item of import, are dutiable at 25 percent ad valorem.

The War Production Board, by Order M-101, effective March 6, 1942, restricted the use of "Block Mica" including mica either split or cut to specified thickness therefrom. On and after the date of the order no person was permitted to put into process any Block Mica of a quality better than heavy-stained, except when it is to be physically incorporated in articles for the armed

forces, lend lease, etc., and then only when the contract terms specify a quality better than heavy-stained.

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Milk

MILK is the white liquid produced from the secretion of the mammary glands of vertebrate animals that suckle their young. The milk which is commonly consumed by man comes from cows, goats and sheep. It is composed mainly of water (87.34%), fat, lactose, caseinogen, lactalbumin and salts. It is a complete food containing protein, fat, carbohydrates, mineral constituents and water.

Milk is produced in almost every county of the U. S. The largest producing areas are the middle west, North Atlantic, New England and Pacific coast states. Production in the U. S. was estimated at about 115.5 billion pounds in 1941. Its principal uses are in market milk and cream, butter, cheese, evaporated milk, ice cream, milk powder and casein.

Following a can of fluid milk from farm to consumer shows some of the things modern milk distribution involves.

First, milk distribution really begins far out on the farms. Inspectors and veterinarians employed by the milk distributor inspect the cattle, buildings and utensils to help safeguard quality.

When the milk arrives at the receiving stations it is inspected immediately to make sure that it has been cooled to the proper temperature. The milk is weighed as a unit and the farmer's number and weight of his milk are immediately recorded with a sample being taken for the various laboratory tests for butterfat and bacteria.

Every milk can delivered by the farmer is washed and sterilized before it is taken back to use again.

Next comes the famed pasteurizing process in which every particle of the milk must be heated to not less than 142° and held at the temperature precisely for a full 30 minutes. Heating to not less than 160° for 15 seconds is now approved in many localities. Pasteurization requires expensive precision equipment. It destroys any harmful bacteria that may be present without affecting the flavor and food value of milk.

Pasteurization is one of the measures which contribute to making milk safe. In large cities where practically all of the milk is pasteurized, milk-borne disease epidemics have been almost eliminated. Such epidemics that do occur are nearly always in areas where milk is not pasteurized.

Next the milk must be quickly cooled down to 40° or less and sent on its way through the shiny spotless pipelines to the filling machines. These machines fill, cap and seal without any contact of human hands.

Milk is sold by farmers by the hundredweight. Cream is sold by the pound of butterfat contained. The consumer buys milk, cream and ice cream by volume (quart, pint, etc.) evaporated milk in 14½ ounce cans and butter, cheese and dry milk by the pound. Prices vary according to locality and season. The government exerts a large influence on minimum prices paid to farmers for market milk and, through lend-lease purchases, on wholesale prices of evaporated milk, cheese and dry milk. Milk is transported from the farm mainly in five and ten gallon cans by truck. It is generally marketed within 12 to 15 hours after milking. Keeping quality and flavor of milk depends upon care in production and the facilities for cooling and maintaining coolness. Milk and cream are graded by Board of Health regulations. State or Federal standards govern the grades for butter and cheese.

There is no substitute for milk, although evaporated or dry milk, or cheese, can be

used as the nutritive equivalent of market milk.

Imports of milk products are comparatively light. There is a duty on all finished products but it applies principally to butter at 14¢ a lb. and cheese at 7¢ per lb.

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Milk Sugar

MILK SUGAR, or lactose is a dissaccharide occurring naturally in milk. The commercial material is either in a white powder or in white hard, crystalline masses. Commercially, milk sugar is obtained from whey as a byproduct of the dairy industry. It is less sweet and not as soluble as regular sugar, but considered a more beneficial food ingredient under certain conditions. The baby food pharmaceutical, and confectionary industries are the principal consumers of milk sugar. The United States Pharmacopeia grade must contain not more than 1/10 percent of ash upon ignition. It is packaged commercially in one and 5-pound tins and bottles, and wooden barrels of various weights. During the first half of 1942 milk sugar was quoted at from 25 to 27¢ per pound. At the beginning of 1941, it was priced at from 16 to 18¢ per pound.

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Millerite

See Nickel

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Mineral Wax

See Ceresin

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Mischmetall

See Monazite

Molybdenum

THE United States is the principal source of molybdenum, used like tungsten in high speed steel and also in all types of engineering steels for use in automotive and other applications requiring high toughness combined with high strength. A silvery white metal (Mo) of the chromium group, it is recovered mostly from the mineral molybdenite. The melting point of the pure metal is 4750° F. and it can be drawn into very fine wire. Its specific gravity is 10.2.

In 1940, it was estimated that the United States produced 34,313,000 pounds of molybdenum of a world production of 36,704,000. Mexico produced 691,000, Norway, 900,000, Morocco 250,000, Peru 450,000, and all others but 100,000 pounds. In normal times, about 50 to 75 percent of domestic production of concentrates is shipped abroad.

Because the United States has ample supplies, increasing attention has been given to the substitution of molybdenum for nickel and tungsten in alloy steels. Molybdenum may be used alone to impart certain desired properties to iron and steel but more frequently it is employed with one or more of the other ferro-alloying elements. Alloy steels containing molybdenum have been finding increased favor in the aircraft industry.

For use in steel, the molybdenite (MoS_2), the principal raw material, is converted either into ferromolybdenum (55 to 70% molybdenum), calcium molybdate (35 to 45% molybdenum) or molybdenum oxide, canned or in briquette form. All these products can be added to iron or steel.

Molybdenum is used to a limited extent in the chemical, color and ceramic fields.

In the United States, Colorado is the largest producing state, but there is also production in New Mexico, Utah and Arizona. All molybdenite is recovered from the rock by flotation—copper sulphide must often be re-

moved from the molybdenum sulphide concentrate.

In June of 1942, molybdenum powder (99 percent) was quoted at $2.60 to $3.00 per pound while molybdenum oxide briquets (48 to 52% molybdenum) were quoted at 80¢ per pound f.o.b. Langecloth, Pa. Ferromolybdenum (55 to 65% Mo) was priced at 95¢ per pound f.o.b. producer.

During December, 1939, exports of molybdenum to certain countries were embargoed by the United States State Department while export control was established on July 2, 1940 when the President ordered licensing of exports of "molybdenum ores, concentrates, metals, alloys containing in excess of 10 per cent molybdenum and molybdenum compounds."

The War Production Board, under Order M-110, effective March 18, 1942 restricted the delivery or acceptance of delivery of molybdenum. The order covered molybdenum in all forms, including scrap.

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Monazite

THE beach sands of India and Brazil supply most of the monazite of the world. In 1938 world production of monazite exceeded 6,000 metric tons of which British India supplied 5,305 tons, Brazil 323 tons (exports), and Netherlands Indies 393 tons (exports).

Monazite was originally processed for its thoria content which was used in the manufacture of Welsbach gas mantles, and the rare earth oxides were cast aside. With the exception of sparking flints (mischmetall) in cigar lighters, few rare-earth products have found an enduring niche in industry, according to studies made by the U. S. Bureau of Mines. While certain products of the group have unique properties, particularly in special glasses, the high cost of the earths precludes commercialization in the majority of uses proposed. However, the search for industrial outlets for the rare-earth metals and compounds continues to develop new and unsuspected uses and possibilities.

The rare earths comprise a group of elements so closely related in properties that their separation is extremely difficult, and consequently they are generally used as the mixed oxides or the mixed metals rather than as separate metals. The Bureau of Mines has reported minor occurrences of monazite in the Scandinavian countries, the United States and other parts of the world, but the low concentration of these deposits makes mining of them impractical and requirements are met by imports from British India and Brazil. Owing to the close similarity in electronic structure of the rare earths they tend to occur as a group rather than as isolated compounds but the percentage composition of the earths is not constant.

When a mixture of rare earths is reduced to the metallic stage, there is formed an alloy known as mischmetall which, when alloyed with iron, is familiar as the sparking flint on lighters. Mischmetall is also used in tracer shells and tracer bullets, the combustion of the metals providing a brilliant light at night. The alloy is also used to some extent in photoelectric cells and in detonators. Because of the superior heats of formation of the rare earth oxides, mischmetall has been proposed as a substitute for aluminum metal in thermite incendiary bombs. The mixed oxides and mixed compounds of the rare earths are used in fluorescent paints, as catalysts, in carbon electrodes for sun lamps, and for mildewproofing tents used in humid climates and canvas fire hose.

Lanthanum (La) a white metal, with a specific gravity of 6.15 and a melting point of 810° C. is easily soluble in acids and oxidizes readily in air. It is one of the rare-earth group obtainable from Monazite by electrolysis, and is mostly used in the form of lanthanum oxide, a white powder. It has been used in an aluminum-piston alloy; and

as a catalyst for weighting silk and rayon, in ceramics, in optical nonsilicate glass, as bactericides, and in nail-polish preparations.

Cerium (Ce), another of the rare-earth group, is iron-gray in color, has a specific gravity of 6.92 and melts at 623° C. It is only used in compound form. Monazite usually contains about 25 to 35 percent cerium oxide, or ceria, which is a pale yellow heavy powder of a specific gravity of 7.65.

Cerium is used in goggle lenses for soda-glass workers as it absorbs the yellow line in the sodium spectrum. Cerium fluoride and cerium oxide are used in stabilizing carbon arcs. Cerium oxide is used for coloring topaz, in opacifying enamels, in fluorescing glasses for mercury-vapor discharge tubes, in X-ray tubes, and in glass for the absorption of ultra-violet spectra. Cerium compounds have been used in moth-proofing fabrics, chemical reagents (as ceric sulfate), mildew-proofing, in photography, as catalysts, in driers and in leather tanning. Cerium fluoride is used as a coating for filter press cloths to protect against the corrosive action of acid liquors and vapors. Cerium oxalate has been proposed as a medicine in the treatment of seasickness, and cerium nitrate has been sugegsted as a bactericide. Cobalt and cerium oxides give a blue color to glass, while chrome and cerium oxides impart a green color. Cerium metal is used in welding electrodes, as a catalyst in commencing certain organic reactions, in the reduction of columbium metal and as a gas purifier in the manufacture of neon tubes.

Praseodymium and neodymium were originally called didymium and were thought to be one element but subsequent research has made possible the separation of the two elements. They are of the rare-earth group. Probably less than a ton of compounds of these two elements are used annually in the United States. Praseodymium oxide gives glass a yellow-green color; neodymium oxide, purple. The mixture of the two oxides colors glass a neutral gray. Reds and blues appear deeper in a landscape when viewed through neodymium glasses, a quality important in measuring and surveying. Neodymium in windshields reduces the glare of transmitted light. Artificial gems containing neodymium give an interesting play of color as the stone is turned and the metal has been used to decolorize glass. Neodymium is used in the manufacture of "neophane" glass for yellow sunglasses and in glasses that apparently have the property of correcting color blindness. Praseodymium, which is more expensive than neodymium, is used to a very small extent in telescope screens to cut out certain undesired spectra.

Other rare-earth metals, not yet isolated for practical commercial use are yttrium, europium and erbium.

Thorium, one of the rare-earth metals, is used in the form of thorium nitrate for incandescent gas mantles. It is never used in its pure state due to its high melting point and the ease with which it combines with oxygen. The impure metal is a gray powder with a specific gravity of 11.3 which burns easily in air with great brilliance. The melting point is 3090° F. The Welsbach mantle used a mixture of 98 to 99 percent thorium oxide and 1 to 2 percent cerium oxide. The thorium nitrate is converted to oxide by ignition and increases tenfold in volume. Thorium compounds are used in flashlight powders. Brazilian monazite sands contain up to 8 percent thoria, which is thorium oxide. The melting point of the oxide, 3000° C. makes it useful for crucibles but too expensive for general refractory use. There is, too, a sensitivity to sudden temperature changes.

Monazite, with a minimum thoria content of 8 percent, is normally valued at approximately $65.00 per short ton, delivered, U.S.A. Strangely enough, demand is principally for the ceria and the thorium is not greatly needed. Florida beach sands are expected to be worked for monazite as well as for

their yield of ilmenite, rutile, and zircon, which are the principal products from beach-sand mining. Even after concentration, most domestic monazite contains less than 6 percent thoria.

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Monel Metal

MONEL METAL is a natural alloy mined in the Sudbury district of Northern Ontario, Canada. It is white, corrosion resistant, workable and strong and contains about two-thirds nickel and one-third copper. (See nickel.)

In peace times, industrial uses include buildings, the chemical industry, dry cleaning, food processing, food service, homes, hospitals, laundries, marine construction, metal pickling, the petroleum industry, public utilities, pulp and paper plants and the textile industry. However the war production program is using the entire output to advantage in various military equipment.

The metal is available in commercial wrought and cast forms, as Monel, "K" Monel, "R" Monel, "KR" Monel, "S" Monel. The "S" Monel contains about 4 percent silicon, the "K" Monel a small amount of aluminum. The "R" Monel, containing about 67 percent nickel, has "free machining" as a characteristic.

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Monoacetylanilin

See Acetanilide

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Montan Wax

MONTAN WAX is a wax-like material obtained by the extraction of lignites, particularly those bituminous lignites found in the Saxony and Thuringia districts of Germany. In a crude state the product is a dark brown, while refined it is white, or light colored. Purification is accomplished by distillation with superheated steam. The melting point of montan wax ranges from 88 to 90° C.

Imports of montan wax during 1939 were 7,178,938 pounds, valued at $659,351. In 1940, imports amounted to 783,265 pounds, valued at $76,270. Montan wax is more closely related to the petroleum compounds than a true wax, and is classed as one of the mineral waxes. It is employed as a substitute for carnauba and beeswax in the manufacture of polishes, candles, phonograph records, paper, sizing compositions, paints, insulating compounds, and adhesives. It is packed in bags.

The price of montan wax on June 1, 1942 was 45¢ per pound, which price had been in effect for some months.

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Morocco

See Goatskins

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Mullet

ONE of the most popular and widely used fish of the South Atlantic is the mullet. It is Florida's most important fish, from point of value and production, and the catch is distributed widely to consumers throughout the southern states.

During 1940 the catch of mullet amounted to 37,126,000 pounds with a value of $1,378,000.

During 1939, the production of mullet was 36,815,000 pounds with a value of $1,197,000. A rise in both production and in prices is clearly indicated. Incomplete reports indicate also that the 1941 production and values will top that of 1940.

The average market size of mullet is between ½ pound to five pounds. They are sold as round and eviscerated fish, both fresh

and frozen. A few are sold as salted fish and, of late, fresh and salted mullet roe has made its appearance. To date very little is sold in fillet form, due to lack of acceptance of this type of product in the deep south. However, a development in this field may be expected in the not too distant future.

The bulk of the catch is caught during the winter months, particularly Oct., Nov., Dec., and Jan. Fairly good catches are reported during the other months with the exception of August and September.

The striped, black or jumping mullet, as it is called, (Mugil cephalus), makes up practically the entire catch. The silver mullet (Mugil curema) is taken commercially only in a few localities.

Mullets can be recognized from other species very easily. The moderately small head is usually about as broad as deep; the eyes in the adult are partially covered with a transparent, fatty tissue called adipose eyelid; the teeth are small and weak; the two dorsal fins are short and widely spaced, the first one being made up of four spines. The striped mullet is most easily separated from the silver mullet by the presence of longitudinal dark stripes, which are lacking in the silver mullet.

Very little is known about this fish. It is believed that they spawn in the late fall and early winter and it is at this time that the fishermen make their largest catches, as the fish gather in schools to migrate toward the open sea. Mullet are a surface fish, running in schools.

Mullet are caught at night, for the most part, in the brackish water close to the shore line. Gill nets of 1½ inch twine are used in catching them as are also the haul seines and trammel nets (a modification of the gill net). Mullet do not take to the hook.

The striped mullet is found in most of the warm waters of the world. In the western hemisphere it ranges coastwise from Massachusetts south to Brazil and from California to Chile. Florida, however, records the greatest catches by far of any other locality.

Mullet are shipped by truck and express packed in wooden boxes, iced down with water ice.

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Muriate of Ammonia

See Ammonium Chloride

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Muriate of Potash

See Potash

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Mustard

MUSTARD is a yellow powder of mustard seed mixed with water for use as a condiment and as a rubifacient or counterirritant. It is widely cultivated in Europe. The seed is imported from Europe and is also produced in the western United States. Domestic production supplies almost all of our requirements. The trading unit is the pound.

There are two classes of mustard seed. The yellow (sometimes called white) is relatively mild. The brown is "hot." Dry mustard is the powder obtained by bolting mustard flour through silk cloth after the removal of the outer hull.

Prepared mustard is a paste manufactured by grinding mustard seed with salt, spices, vinegar or other condiments. Prepared mustard made from yellow seed is mild, and often referred to as "salad mustard." That made from the brown seed is a hot mustard. The most popular type in this country is a prepared mustard made of a blend of yellow and brown mustard seed. Horseradish mustard, a "hot" product, is made from brown mustard seeds with the addition of grated fresh horseradish.

Mustard seeds are bought from the producer on the pound basis, with July, 1942,

values ranging from $6\frac{1}{2}$ to 7 cents per pound for the yellow to 13 to 19 cents for the brown. It is packed in 100 pound bags, and may be shipped by either rail or truck.

Prepared mustard is packed in glass, generally in 8, 16, or 32-ounce containers. Prices per dozen for competitive grades of mild mustard are 50 cents for 8 ounce, 62 cents for 16 ounce, and 89 cents for 32 ounce, with the "hot" mustards slightly higher, these prices being f.o.b. factory. Advertised brands sell at much higher prices.

Mustard seeds require storage in cool spaces; the prepared product may be handled normally, but must be protected against freezing.

Import duty on mustard is 10 cents per pound for ground, prepared, and sauce; 10 percent on bran or dross.

Mustard seeds are not under the General Maximum Price Regulation; the prepared product is subject to price ceilings.

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Mustard Oil

MUSTARD or mustardseed oil is a colorless or yellow oil obtained from the seeds of the black mustard plants, Brassica nigra or Brassica juncea, or manufactured synthetically. The natural oil is produced by grinding the mustardseeds, expressing their fatty oil content, then mixing them with warm water, and after a fermenting period distilling off the volatile oil formed. On standing the oil darkens. Its chief constituent is allyl isothiocyanate, of which at least 93% must be present to satisfy United States Pharmacopeial standards.

Imports of artificial mustard oil in 1939 amounted to 4,392 pounds, valued at \$5,276, all of which originated in Germany. Commercially natural oil of mustard is packed in one-pound bottles or cans; the artificial oil is put up in five-pound bottles. Practically all of the oil is used in medicine.

Pricewise, natural mustard oil on June 1, 1942 was \$9.50 to \$10.00 per pound. This price was also in effect at the beginning of 1942 and 1941. The artificial oil was priced at approximately \$1.50 per pound during the same period.

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Myrtle Wax

See Bayberry Wax

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Nepheline Syenite

NEPHELINE SYENITE is a sodium aluminum silicate rock used as a raw material for the ceramic industry. It is secured by the open quarry method, about 35,000 tons being produced annually. The principal source of supply is found in Ontario. The "Glass" grade is priced at about \$12.00 per ton; and the "Pottery" grade at about \$15.50. It is non-perishable. Grading is by mesh, and ranges from 20 to 200 mesh. There are no substitutes and no U. S. import duty.

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Native Paraffin

See Ozokerite

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Naval Stores

See Turpentine and Rosin

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Neodymium

See Monazite

★ ★ ★

Neoprene

See Synthetic Rubber

Newsprint

See Paper

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Niccolite

See Nickel

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Nickel

ALTHOUGH nickel was utilized in coins, ornaments and dagger blades of ancient times, up until 1875 the world consumed scarcely 500 tons per year. The opening of deposits in New Caledonia and, later the development of the Sudbury deposits of Canada (shortly before the turn of the century) made large supplies available. While production at the turn of the century was about 20,000 tons, by 1939 the world was using 128,000 tons.

A silvery-white metal with a yellowish cast, nickel was first isolated in 1751. Its ores are sulphides, silicates, and arsenides, the most common being the mineral Pyrrholite or Magnetic pyrites. Nickel has a specific gravity of 8.84 and melts at 2646° F. The metal is resistant to corrosion and will resist most acid, nitric an exception. The electrical conductivity is 15 percent that of copper. Because it absorbs oxygen, when pure, and dissolves carbon and sulphur, it is difficult to cast. It comes on the market as grains or powder, in electrolytic sheets, shot, blocks, and in malleable forms. The tensile strength of the hard rolled sheet is about 115,000 pounds per square inch. The standard grades of virgin nickel are: electrolytic (99.5%); X shot (98.9%); A shot (97.75%); and ingot (98.5%).

Nickel is used largely in alloys. It resists many types of corrosion and has the ability to impart its resistance to alloys of which it is a part. It is used in stainless steel, which in turn has many uses. Stainless steel has been used in the construction of streamline trains and airplanes. Stainless steel and other nickel alloys, like Monel, are used in food processing and packing industries, in canning factories, homes, restaurants and hospitals. Nickel alloy steels, because of resistance to cold, are used in the manufacture of bridges, locomotives and buildings. Nickel silvers are used for ornamental objects, hardware and plumbing features. It is often essential as an underplating when automobiles are chromium plated. Nickel is widely used in electrical appliances, magnets, thermostatic devices and radio receiving sets. Prior to the war, the United States' five cent piece contained 25 percent of nickel and 75 percent of red copper.

Nickel will combine with copper in all proportions and raises the melting point of copper alloys. It is used for color effect and for toughening in brasses and bronzes and is employed in many alloys to produce heat-resistance and acid-resistant products.

Garnierite is an important ore of nickel, found in New Caledonia. It is a nickel silicate with a specific gravity of 2.2 to 2.8 and a hardness of 3 to 4. The ore contains about 5% nickel and is smelted with gypsum and further reduced with charcoal. Millerite is a minor nickel ore occurring in Europe and parts of the United States. A nickel-sulphide, it contains about 65 percent pure nickel. Pale yellow in color, it has a metallic luster and is found as slender crystals. The specific gravity is 5.65 and the hardness 3.5. Niccolite, another minor ore with about 44 percent nickel, is mined in Canada, Germany and Sweden. A nickel arsenide, usually containing a little iron, cobalt and sulphur, it is pale copper-red, has a specific gravity of 7.5 and a hardness of 5 to 5.5.

Nickel is the sixth most common element in the world but only in a few places is it found in sufficiently large deposits to make mining practical. The most important of

these deposits is near Sudbury in northern Ontario, Canada. A substantial portion of the world's supply of nickel is produced there.

Owing to the war, statistics on world production are no longer available. During 1938, however, world output amounted to 115,500 metric tons. Canada accounted for 95,514 tons of that total. New Caledonia produced 11,700 tons and the balance was scattered among numerous other countries and territories.

The United States obtains most nickel requirements from Canada. The principal imports are in the form of metallic nickel and nickel alloys, matte (containing approximately 55 percent nickel and 25 percent copper), and nickel oxide. Minor quantities of secondary metals recovered from scrap-nickel anodes, nickel-silver, and copper-nickel alloys are produced domestically. Small quantities of primary metal recovered in copper refining also are produced here.

The war has caused the elimination of non-essential uses in the United States. Industry-wide priority control was established March 7, 1941. Subsequent measures tightened controls further. With war needs considerably in excess of supplies, all but the most essential civilian uses were abolished.

Under Price Schedule No. 8, ceilings were placed on nickel scrap and secondary materials containing nickel.

During 1942, electrolytic nickel at New York in 2-ton minimum lots was sold at 35 cents per pound. Prices in Canada and the U. S. have been unchanged for over 15 years.

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Niobium

See Columbium

★ ★ ★

Nitrate of Soda

See Sodium Nitrate

Nitrogen

See Fertilizers

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Noble Fir

See Spruce

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Nutmeg Oil

NUTMEG, or myristica oil is a thin, colorless or pale yellow oil distilled from the small, and damaged seeds of Myristica fragrans, which is cultivated in the East and West Indies and Brazil. It is official in the United States Pharmacopeia. In nature, nutmegs are enclosed in a thin pericarp, or seed vessel, which is surrounded by the material known as mace in the spice trade, all of which is enclosed in a fleshy drupe. The pericarp of the nutmeg is easily removed following its being dried artificially. For preservation against insects the nutmegs are then "limed" by dusting with slaked lime or immersion in milk of lime. On arrival in this country the nutmegs are sieved according to size, the sound specimens are then usually sold as spice, while the damaged nutmegs are distilled for their oil.

Nutmeg oil is used in medicine, as a flavoring compound ingredient and occasionally in perfume blends. The commercial packing is in 50-pound tins. Pricewise, nutmeg oil on June 1, 1942 was $4.75 per pound. On January 1, 1942 it was priced at $2.50 per pound; and one year earlier at $2.20 per pound.

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Nylon

NYLON is the generic name of all materials defined scientifically as synthetic fiber-forming polymeric amides having a protein-like chemical structure; derivable from coal, air and water, or other substances and

characterized by extreme toughness and strength and the peculiar ability to be formed into fibers and into various shapes, such as bristles, sheets, etc.

The first of the non-cellulose yarns to win wide recognition in the hosiery field where it competes successfully with silk, nylon's uses were growing by leaps and bounds until war demands proceeded to curtail the amount available for civilian use.

It has been used successfully in shower curtains and raincoats, replacing oil silks and in umbrella clothes, in sheer fabrics for evening wear, and in sewing thread, to mention but a few items.

Nylon bristles, a new chemically developed bristling filament made from nylon by duPont for use in toilet brushes, lasts much longer than the natural hog bristle and is not softened by water or saliva. It is made by forcing a plastic polymer through holes, much as viscose rayon is made. The filaments can be formed into any required length and diameter and the stiffness can be controlled.

Recent tests have disclosed that nylon can be utilized for parachutes, replacing silk. This is but one of the extensive war-time uses.

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Oak

See Hardwoods

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Oats

OATS are grassy plants (avena), the grain of which is used primarily as feed for animals and, to a lesser extent, in the production of human food. The crop is produced on a large scale in practically all areas of the temperate zone.

Like most other agricultural crops, production is governed by acreage and yield. Climatic conditions, disease and insects chiefly determine the yield.

In the south, the crop is seeded in the fall but this represents a small portion of the total area sown. The largest producing regions lie north and the bulk of the crop is planted in the spring and harvested in the summer. Moisture is essential to oats and it should be well distributed for good results. Moderately cool weather is desirable. The plant is highly susceptible to damage from intense periods of heat occurring as the crop starts to head and ripen. Among the most important types of plant diseases are the stem and crown rusts; also, the loose and covered smuts. One of the chief forms of insect damage is the green bug, although some of the insects which prey upon other grains will also damage oats.

Oats are particularly suited for the crop rotation practiced on many farms. The usual procedure is to plant corn or some other row crop followed afterwards by oats and subsequently grass or legumes, then corn again, etc. These considerations, plus favorable climate, account for the fact that the leading oat producing areas are located in the Corn Belt States. Iowa is the largest producing state in the Union, followed by Minnesota, Illinois and Wisconsin. The leading producing nations of the world are the United States, Russia, Germany, Canada and France. World production ranges from 4 to 5 billion bushels annually. U. S. production has averaged a little more than one billion bushels annually in recent years.

Oats are produced mainly as a feed for livestock, workstock and poultry. They are also fed to young stock and breeding stock because of bone and muscle building qualities.

The manufacture of various forms of oatmeal for human consumption absorbs many millions of bushels of oats, but the total so used is small compared to the total crop.

The chief food products are rolled oats (or

oatmeal), oatmeal crackers, etc. Rolled oats (or oatmeal) is America's No. 1 whole grain food. It is rich in protein and in thiamine (vitamin B_1) and is an excellent source of food energy, phosphorus and iron. More breakfast food is produced from oats than from any other single grain. Various by-products are derived from the oat milling industry which form the basis of mixed feeds. Chief among these are oat feed and oat middlings, which are usually sold in mixed form. Oat hulls are an important source of several chemical compounds in the furan group. Of these furfural is the leader. It is used as a selective solvent in oil refining, in the manufacture of resins and plastics, as a fungicide and bactericide, etc. Only a negligible portion of the oat crop is exported from the United States in average years.

The unit of trade is the bushel, weighing 32 lbs. The usual marketing quantity is the car-load, approximating 1,800 bushels. The May, 1942, price was about 50¢ a bushel in Chicago. Transportation is mostly by rail and truck.

Oats are classed on a color basis into four types. These are white (including yellow oats), red, gray and black. Each class, in turn, is graded 1, 2, 3 and 4.

Substitutes for oats consist of other grains and feedstuffs.

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Oil Cake

See Gluten Feed

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Oil Cake Meal

See Gluten Feed

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Oiticica Oil

OITICICA OIL is produced from the nuts of the wild oiticica tree. The oil is derived by crushing and extraction. It is produced in the arid northeastern section of Brazil. Motivated by the desire to protect its oiticica industry, Brazil has passed strict regulations forbidding the export of oiticica seeds. Successful experimentation has made possible the future cultivation of an early maturing variety of plant of high oil content. Production in 1941 approximated 20,000 tons.

Oiticica oil is used in the manufacture of varnishes, paints, linoleum, oil-cloth and printing ink. It is regarded as the foremost competitor of tung oil and there has also been an increasing substitution of oiticica for perilla oil. The price in May, 1942 (drums, N. Y.) averaged 25.2 cents per pound. It is transported principally from Brazil by steamer.

There are three types of oiticica oil: (1) Crude oil, natural or condensed; (2) polymerized oil, which is more expensive than crude and (3) permanently liquid oil. The last mentioned type is laboratory tested with standard specifications and is the highest priced of the three groups.

Oiticica oil is not subject to duty.

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Oleoresin

See Turpentine and Rosin

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Olives

OLIVES are the fruit of a tree cultivated since antiquity throughout Asia Minor and southern Europe, and now cultivated extensively in California. The fruit is an important source of oil and is eaten as a pickle or relish when green. The ripe olive is bluish-black in color, and is also eaten.

There are two main commercial types of olives in brine—the green, or unripe olive, which comes largely from Spain, and the ripe or black olive, which is produced on a large scale in California, replacing Greek

olives of this type formerly sold largely in this country.

Imported olives are marketed as Plain Queens and Stuffed, the latter being pitted and stuffed with pimento or some other type filling. The trading unit is the gallon, with plain olives shipped in 170-gallon hogsheads and the stuffed in 48-gallon barrels. They are packed for the consumer trade in this country in bottles or jars, the trading unit being per dozen containers. Green olives are graded by size to show the number to the kilogram, as follows: 60/70's; 70/80s; 80/90s; 90/100s; 100/110s; 110/120s; 120/130s; 130/140s; 140/150s; 160/180s. The 60/70s run 38 to 40 olives to the quart. For the consumer trade, olives are bottled in sizes running from $1\frac{1}{2}$ ounce to one gallon.

Bulk green olives must be guarded against mold, which softens the fruit, which darkens unless kept in a cool, airy place. Properly brined and stored, they will keep up to two years.

While green olives are used to some extent in the manufacture of relishes and cheese spreads, they find their greatest sale to the consumer in plain or stuffed form. July, 1942, market values, in original barrels per gallon, were: Queens, 70/80s, $2.00; 80/90s, $1.75; 90/100s, $1.65; 100/110s, $1.60; 110/120s, $1.58; 120/130s, $1.55; 130/140s, $1.52; 140/150s, $1.50; 150/160s, $1.45; 160/180s, $1.45, with smaller sizes nominal; Stuffed Queens, 70/80s, $2.70; 80/90s, $2.60; 90/100s, $2.45; 100/110s, $2.40; 110/120s, $2.35; 120/130s, $2.35; 130/140s, $2.35; 140/150s, $2.35; 150/160s, $2.00; smaller sizes nominal.

Import duties on olives are: Dried ripe, 5 cents per gallon; stuffed 30 cents; green in brine, 20 cents; pitted in brine and ripe in brine, 30 cents.

California Olives

California ripe olives come in three grades: Missions and Manzanillo, Sevellanos, and Ascolanos. They are purchased from the grower on the basis of per ton and sold largely in canned and bottled form, although there has been considerable pressing of California olives into oil, and more are now being marketed green in an effort to capture part of the American market from the imported product.

California figures for the past 5 years and the dispositions of these yields follow:

	TONS			
	Crop	Canned	Oil	Other Uses
1937-38	27,000	11,580	11,461	835
1938-39	42,000	6,883	25,036	2,997
1939-40	22,800	12,000	6,500	500
1940-41	60,000	16,000	26,000	....
1941-42	43,000	16,000	20,000	....

Prices paid growers have risen sharply since the outbreak of war. A comparison of prices to growers for the years 1939 and 1941 shows that processors paid $60 to $110, as to grade, for Missions and Manzanillos in 1939, whereas growers received $125 to $225 per ton for these same grades from the 1941 crop. Sevellanos, which ranged $110 to $200 in 1939 brought $135 to $225 in 1941 and Ascolanos jumped from $85 to $200 per ton in 1939 to $95 to $225 per ton for the 1941 crop.

Under the WPB tin conservation order, ripe olive processors can no longer pack their product in tins. Considerable quantities are now being packed in glass as a consequence. Prices for the canned and bottled olives vary according to brands.

California olives are subject to the same storage requirements as the imported.

Both the imported and domestic olives come under the General Maximum Price Regulation.

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Olive Oil

OLIVE OIL is a nondrying oil, pale-yellow or yellowish-green in color, derived from olives. The olive tree has been cultivated for

its fruit throughout Asia Minor and the Mediterranean areas of Europe and Africa for many centuries. The olive tree has a low trunk, often gnarled, and willowlike leaves. The fruit, in addition to providing oil, is eaten as a pickle or relish when green.

Olive oil is produced in Spain, Italy, Greece, Portugal, Algeria, Tunisia, French Morocco, Turkey and Syria. Its principal uses are in table oil, French and other salad dressings, and in cooking. Small quantities have been used in the production of soap while foots are used for the same purpose and, to a minor extent, in the drying industries. It also has certain medicinal uses.

The curtailment of imports occasioned by the war has resulted in a sharp decrease in consumption in the United States. The apparent consumption of edible oil dropped from 65,842,000 pounds in 1939 to 22,077,000 pounds in 1941. In the same period inedible consumption dropped from 8,923,000 pounds to 2,611,000 pounds while the use of olive oil foots declined from 26,116,000 pounds to 11,354,000 pounds.

During May, 1942, the price of edible olive oil (drums) New York averaged 72.7 cents per pound; inedible olive oil, 58.3 cents per pound and prime olive oil foots 19.5 cents.

Olive oil tends to become rancid on exposure to air. It should be kept well closed, cool and protected from light.

The duty on edible oil in packages weighing less than 40 lbs. is 8 cents per pound; in packages of 40 pounds or over, 6½ cents per pound.

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Onyx

CLOSELY allied to agate, onyx is a chalcedony silica. It occurs in parallel layers of different, alternating colors. Like agate it is often artificially colored.

It is used mostly for decorative articles, such as cameos.

Mexican onyx, a form of aragonite a calcium carbonate mineral, is utilized for a variety of objects while Brazilian onyx is the dark green or green-yellow translucent stone used for book ends, inkstands, etc.

On occasions onyx is used as a building stone.

Certain petrified wood of the western United States, closely resembling both agates and opals in appearance are substituted for onyx in decorative articles and gems.

Prices cover a wide range depending on the quality and special variety of product involved.

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Optical Glass

OPTICAL GLASS is the most refined product of the glassmaker's art. It must be transparent over the whole visible spectrum. It must be free from strain, striae, bubbles, feathers, and the refractive index and dispersion ratio must be constant. As many as fifty types are made by the leading manufacturers. It is processed by mixing a chemical batch, comprised chiefly of silica, lime and potash with numerous elements added, and melted in a furnace at about 2600° F., then annealed in the pot or in sheets. About 3,000,000 pounds have been produced annually in the United States, of the optical and ophthalmic types. Its principal use is in optical instruments for scientific use, in military instruments for gunfire control, and in eyeglass lenses. It is sold on specification of optical parts by instrument builders, or bought by the pound by users who can make finished parts. Prices naturally vary greatly with the type of glass, its perfection, and the size of the piece desired. It is usually transported by express, packed in boxes. Principal types are crowns, flints, barium, and borosilicates. It is regarded as one of the most important war materials because of its use in

range and height finders, binoculars, and a number of other war instruments. While production is at a high rate, raw materials are considered ample.

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Orange Oil

ORANGE, or sweet orange oil is a yellow to deep orange or brown liquid obtained by distillation or expression of the peels of the sweet orange, Citrus aurantium, which grows natively in Northern India, Spain, and the West Indies, and is cultivated in the Mediterranean area, California, Florida, Brazil, and other places. United States requirements are supplied in the main by domestic production. The United States Pharmacopeia standardized the cold expressed oil, which is the highest in quality. Hot expressed and distilled oils are of lower quality.

Brazil has become an important producer of the oil in the past few years, and promises to increase in importance. Production there was started in 1935, but it was 1939 before sizable quantities were expressed. In the latter year 5,234 kilos were produced. In 1940 the figure increased to 12,400 kilos, and in the first nine months of 1941 production was 67,564 kilos. Production during 1942 is estimated at 290,000 kilos. The United States took 96 percent of Brazil's production in 1941. The leading types of Brazilian orange oil are the "baia" and "pera" with the latter bringing a slightly higher return to the producer.

The supply of orange oil for the United States consumer is said to be entirely satisfactory. Since the oil is used principally in flavoring soft drinks and in candies, it is thought that sugar rationing will curtail the use of the oil, and thus lead to the accumulation of stocks. Simultaneously the shipping situation is building a backlog of the oil in Brazil and in Africa, also an important producer.

United States imports of orange oil in 1940 amounted to 198,458 pounds, valued at $126,480. The French African colonies supplied 143,391 pounds; Brazil 20,140 pounds, and Jamaica 17,078 pounds. In 1939 the imports totaled 237,289 pounds, valued at $172,408, with French Africa shipping 172,016 pounds, France 32,787 pounds, Italy 23,001 pounds, and Jamaica 7,295 pounds. Imports of terpeneless orange oil in 1940 was 290 pounds, valued at $6,583; and in 1939, 662 pounds, valued at $20,517. The Netherlands was the largest supplier in both years. Commercially, oils other than Italian are packed in 25-pound tins. The Italian oil is packed in 25-pound and one-pound coppers. Argentine oil is sometimes encountered in ten-kilo tins. Terpeneless and concentrated oils are shipped in one-pound bottles.

On June 1, 1942 California expressed oil was priced at $3.25 per pound; Florida oil at $2.85; Brazilian oil at $2.85; and Italian at $8.00 per pound. On January 1, 1942 the Californian oil was $3.00; Florida $2.85; Brazilian, $2.85; and Italian $8.00. One year earlier the California oil was $2.00; the Florida, $1.25; and the Italian, $8.00 per pound.

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Oregon Pine

See Douglas Fir

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Origanum Oil

ORIGANUM or wild marjoram oil is a yellow oil with a thyme-like odor obtained by distillation from various species of marjoram found in the Mediterranean countries. The oil darkens with age. Commercially origanum oil is sometimes sold as thyme oil,

which latter material is official in the National Formulary. The chief constituents of origanum oil are carvacrol and cymol. The Trieste variety of the oil also contains thymol, and a Smyrna variety also phenol. Other varieties originate in Cyprus, Greece, Sicily, Syria, and Spain.

Origanum oil is used medicinally and as a flavoring material. Its price on June 1, 1942 was $2.70 per pound, for the Spanish variety. In the first month of 1942, it was slightly higher, while at the same time in 1941, it was priced at $1.05. It is packed commercially in 50-pound tins.

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Orthophosphoric Acid

See Phosphoric Acid

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Osmiridium

See Iridium

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Osmium

A METALLIC element, one of the rare platinum group metals, osmium has the highest specific gravity listed, 22.50. It occurs as a native alloy with iridium (osmiridium) and, while having a much greater hardening power on platinum, volatizes so rapidly into a poisonous gas that its use to replace iridium is small. Like other platinum metals it has a high melting point, 4890° F.

Its use in normal times is mostly in the manufacture of pen points, as an alloy with other metals, mostly as osmiridium. The points so constructed will resist wear and corrosion from ink. These alloys also replace jewels as bearings in fine instruments and the oxide is used as a biological stain for fats and fingerprint work.

Total United States sale of iridium, osmium, rhodium, and ruthenium combined in 1940 totaled but 14,593 ounces. Imports of osmium and osmiridium in 1940, almost wholly from the United Kingdom, amounted to 1,857 ounces, compared with 2,204 ounces in 1939 and an average of 3,380 ounces during the five years 1935-39.

In mid-1942, osmium was quoted at $60.00 to $80.00 per ounce.

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Ostrich Skins

See Birdskins

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Oxyacetylene

See Acetylene

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Oysters

OYSTERS are one of the most important of the shellfish famiy. Long prized by epicures, they are now also greatly desired by the general public for their exceptional food values.

There are four types of oysters grown in the United States today. These are: Eastern, public; Eastern, private; Western and Pacific.

Eastern, public stock, are taken by public oystermen from public grounds owned by the various oyster producing states and localities. Eastern, private stock, are an exceptionally high quality oyster, cultivated and grown by private oyster companies or individuals on their own or leased sea areas. These latter oystermen are known as "farmers of the sea" for they have much the same problem and do much the same type of work as the farmer on land, with the exception that they work on the bottoms of the seas. The Eastern oyster is the Ostrea Virginica.

On the West Coast there are two types of oysters. The Pacific, also known as the Japa-

nese (Ostrea Gigas), and the Western, known as the native or Olympia (Ostrea Lurdia).

There are some forty-eight oysters belonging to the family Ostrea that are found in various parts of the world but the American oysters are by far superior to all others.

Domestic production for 1940 was divided as follows: Eastern, public, 40,677,000 pounds valued at $3,121,000; Eastern, private, 37,723,000 pounds, valued at $4,600,-000; Pacific, 10,757,000 pounds valued at $610,00; Western 227,000 pounds valued at $136,000.

In the United States oysters are the most widely distributed of our seafoods. They are found in the salt and brackish waters of every state along the Atlantic Coast from Maine to Texas, inclusive, and in Washington, Oregon, California and Alaska on the Pacific Coast.

Oysters are sold as shucked and shell stock, that is with and without the shell. Shucked oysters are sold in pint, half pint, quart, half gallon and gallon containers. Fibre cups of approximately six ounces content are also used for retail sales. Fibre containers of the pint and quart sizes are also used. At the present writing tin containers are still available to oystermen in gallon sizes only but the industry is turning to the fibre (paper) container as a way out in the packaging problem.

Shell oysters sell at retail by the dozen and are shipped wholesale in burlap bags (cotton bags now) and in wooden barrels and bushel boxes.

Oysters are also canned. Most of the canned oysters come from the southern or Gulf states and the West Coast. The pack, 1940, was put up by 44 plants for a total of 644,546 standard cases valued at $2,526,-859. (A standard case is 48 five ounce cans to the case).

A small amount is being sold as quick frozen, packaged oysters but it is comparatively insignificant in volume.

Federal specifications of oysters are: Grade A, averaging 150-200 oysters per gallon; Grade B, 200-250 oysters per gallon and Grade C, 250-300 oysters per gallon. Another grade, D, 300 and over, may be added by army requirements.

Canned oyster specifications are: Type—shall be of the type known commercially as Cove and Pacific oysters.

The oyster season is generally considered to be during the "R" months, although large quantities are harvested and sold during the summer months in many localities. Oysters are a perfect food the year round although the colder the waters from which they come the better is the oyster.

Pacific oysters are graded differently from the Eastern. Western grades are: AA, under 90 oysters per gallon; A, 34 to 115; B, 116 to 140; C, 141 to 160 and D, 161 and over.

It takes from two to four years for an oyster to mature. It must reach a size (shell) from four to six inches before it is ready for market. A good half shell oyster is generally about four inches long. The large oysters are used for frying and the smaller for half shell and stews, etc.

Oysters are dredged from the bottoms, usually fairly shallow waters of bays, inlets and certain salt water rivers. They are always quite close to shore. Oysters are also taken from the waters by hand tonging in row boats or small power boats. An oyster dredge boat, operating two large dredges is a large size vessel of no standard size but usually diesel powered.

There are no price ceilings on oysters and, to date, none of the large oyster dredgers have been taken over by the navy. (There is a price ceiling on canned oysters.)

Most oysters are shipped by truck and express. Shell stock require no icing but shucked oysters must be refrigerated. Water ice, packed around the individual containers, is the accepted method.

* * *

Ozokerite

OZOKERITE is also known as native paraffin and fossil wax. It is a wax-like mixture, varying in color from yellow-brown to black or green in color. Ozokerite is found in nature, and is believed to have been formed by the evaporation of petroleum. The chief deposits of ozokerite are located in Utah, certain central European sections, and around the Caspian Sea. It is purified by melting with hot water, then straining or filtering to remove dirt and stones. It may be bleached by melting with activated carbon.

Commercially, congealing point and color are employed to identify several grades of ozokerite. A hard green variety is generally offered in three congealing ranges, varying overall from 66 to 76° C. Yellow and Snow-white grades congealing at from 76 to 78° C. are also sold. All of the grades are packed in bags. Imports of ozokerite in 1939 totaled 596,588 pounds, valued at $114,176. Of this quantity, Italy furnished 300,855 pounds and Germany, 208,123 pounds. In 1940, imports amounted to 177,782 pounds, valued at $34,455.

Like the other wax materials, ozokerite is employed in candles, paints, polishes, insulating compositions, printing inks, and as a lubricant. It is also used for the manufacture of ceresin.

* * *

Palladium

ONE of the most extensively used metals of the platinum group, palladium (Pd), resembles platinum but is lighter in weight (specific gravity 12.16). Although only half as plentiful, its price is under that of platinum. It is highly resistant to acids and corrosion but like gold can be dissolved in aqua regia. The melting point is 1549° F.

Palladium, pure or alloyed, often with gold, is adapted to many of the uses of platinum. In 1940, it comprised 69,319 ounces or 33.5 percent of all sales of platinum metals in the United States. Recovery by refiners in the United States in 1940 amounted to 21 ounces from crude platinum; 3,183 ounces from gold and copper refining; and 1,360 ounces from imported materials. This total of 4,564 ounces contrasted with 3,491 ounces in 1939. In addition, 14,773 ounces were recovered from the treatment of scrap metal, sweeps and other waste products. Imports of palladium in 1940 were 60,204 ounces of which 5 came from the Argentine, 10,168 from Canada, 443 from Norway, and 49,588 ounces from the United Kingdom.

Palladium has remained steady in price at about $25 per troy ounce, more than $10 per ounce under the price of platinum. In mid-1942 the price was $23.00 to $25.00 per ounce.

During the past two decades, the metal has been employed in increasing quantities by the dental, electrical and jewelry industries. The conservation of gold by certain countries, served to stimulate the demand for platinum metals, particularly palladium and the substitution of palladium for gold alloys has made substantial progress. There has also been an improved market for palladium in the electrical industry, which took 47 percent of 1940 sales for use in telephone relays and other types of contacts. Dentistry was next, using 38 percent while the jewelry industry took almost all the balance except for small quantities entering the manufacture of chemical ware.

* * *

Palm Kernel Oil

PALM KERNEL OIL is the product obtained by crushing the kernel of the fruit of several varieties of palm trees, native to Africa and the Dutch East Indies. Crushing is done in mills at points in Africa, and the D.E.I. and

occasionally in the United States. The saponification value of the oil is about 205. World production is estimated at about 600,000 tons. The United States, in 1940, imported about 13 million pounds, principally from the East Indies. Chief uses are in the manufacture of edible products, such as margarine, "hard butter" for the confectionery trade, etc., and in soap. The war naturally disrupted imports. Marketed within the United States, it is usually in tank car lots, after being transported here in tank-steamers. Last quoted prices were 7⅜¢ per pound tank cars —Pacific Coast, duty included, but not excise tax. There is a processing tax of 3¢ per pound; no import duty if denatured. It can be held for from two to three years without serious deterioration. There is only one grade, known as palm kernel oil. Other oils, such as cocoanut oil, babassu oil, etc. are listed as substitutes.

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Palm Oil

PALM OIL is derived from the seed nuts of certain species of palm trees. The palm tree grows to a height of about 60 feet and produces nuts in large bunches resembling dates. The fruit usually is about 1½ inches long, containing in most instances, a single kernel. The fleshy part of the nut contains about 65 per cent of oil with an iodine value of about 55 and saponification value of 205. Commercial production occurs mainly in British West Africa, Belgian Congo, French West Africa, Netherlands East Indies, and British Malaya.

The principal use for palm oil in the United States is in the manufacture of soap. Other uses are in the production of shortening and other food products and, as a fluxing dip in the manufacture of tin plate. Factory consumption of palm oil in the United States during 1941 amounted to about 278 million pounds of which 47 per cent was used for soap, 35 per cent in food products and 15 per cent for tin and terne plate.

The war in the Far East curtailed imports of palm oil and strict controls were imposed. General Preference Order M-59, issued by the War Production Board, limited the use of palm oil beginning April 1, 1942 to the manufacture of tin plate, terne plate, steel sheets, steel strip and black plate and to manufacturing processes where glycerine is produced. Like other fats and oils, prices were subject to ceilings since December 13, 1941. Effective May 22, palm oil was placed on list A of strategic materials, the imports of which were regulated by the government.

The price of crude palm oil (Niger) in drums at New York averaged 12 cents per pound during May, 1942. The three-cent processing tax was added to the price as originally quoted in arriving at this computation.

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Pao Santo

THE bark of the Brazilian tree, Angica Revada, Pao Santo has been in use for over twenty years and is described as the raw material closest to natural cork that a world-wide search has been able to uncover.

It is stripped from the tree trunks with machetes in much the same way that cork is harvested in Europe. Until lately, Pao Santo had not entered into competition with cork because it was more expensive, not as readily accessible to consuming markets, and adjudged to have only about 85 percent of cork's merits.

It is not as thick as cork, but practical for grinding into powder. Many Brazilians call the product "Cortica Nacional."

Pao Santo can be cut earlier and more often than cork. The specific weight is 140 to 145 kilograms per cubic meter; a ton bale occupying about 135 cubic feet. While not suited as bottle stoppers, it should meet

specifications for cork flooring and other uses.

Unlike Spanish or Portuguese cork, it comes in small pieces. While it is usually shipped in bags, it could be compressed and shipped in bales. The number of "cork" trees in Brazil is known to be enormous but Pao Santo is not cultivated, nor does it grow in groves, and research into methods of production and care of trees is needed.

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Papain

THE dried juice of the papaya fruit, also known as the pawpaw, papaw or melon tree. Papaya flourishes in the island of Ceylon. Lately, however, Florida has built up a sizable papaya-fruit industry, commercial plantings totaling several hundred acres, and the papaya is also cultivated in Texas, along the Rio Grande and in California, under glass. The industry too, is developed in Mexico, Central America and throughout the West Indies.

In 1940, the United States imported 255,408 pounds of papain, of which 68 percent or 173,032 pounds came from Ceylon. British East Africa supplied 18,517 pounds; the U. K., 16,622 pounds; South Africa, 11,141 pounds; Thailand, 3,300 pounds; Japan, 2,480 pounds and New Zealand, 316 pounds.

The latex or milk of the pawpaw is obtained by making a few scratches on the full-grown but green fruit with a bone or bamboo knife while it is still on the tree. The melons can be tapped every 4 or 5 days, or at longer intervals until they cease to yield. The "tears" are caught in a glass or porcelain container while the coagulated latex is then dried as rapidly as possible either in kilns or in the sun until it separates into a powdery substance, white or creamy in color.

The most important use of papain in the United States is in medicine, although its greatest volume use is in preparations designed to tenderize tough steaks and other meats. Considerable quantities are also used in chewing gum. In the textile industry, papain makes wool non-felting and de-gums silk. In the leather industry it de-hairs hides. Containing an active enzyme similar to pepsin which breaks down proteins in foods, it is used in various preparations for the relief of dyspepsia and gastric catarrh.

With our regular sources of papain cut off, it is clear that production in the West Indies and elsewhere in Central and South America, must be encouraged.

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Papaya

See Papain

★ ★ ★

Pawpaw

See Papain

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Paper

THE principal fibrous raw materials upon which the domestic paper industry relies are wood pulp, waste paper, straw and rags. The relative importance of each of these is indicated in the following table which indicates the estimated percentage of each used in respect to total fibrous raw material consumption:

Wood Pulp	61.0%
Waste Paper	30.5%
Straw	4.0%
Rags	4.0%
Other Fibre	0.5%

As indicated, wood pulp is the most important single fibrous raw material. The United States is the largest consumer, producer and importer of wood pulp in the World. Current consumption is estimated at

in excess of 9,000,000 tons per year. Prior to the war, wood pulp moved in substantial volume from Scandinavia. Imports from Scandinavia in 1939 totaled 1,300,000 tons or approximately 16% of our consumption and 64% of our total imports. At the present time, imports from Scandinavia, due to the war, are negligible. The withdrawal of Scandinavian pulp from the domestic market has substantially increased the demands upon the United States and Canadian pulp producers. These increased demands upon the domestic and Canadian industries have, to date, been satisfactorily meet.

The four major pulp producing areas in the United States are as follows:

1. The New England and Middle Atlantic District
2. The Lake States
3. The Pacific Northwest
4. The South

There are forty-six pulp mills located in New York State thirty-six in Wisconsin, thirty-three in Maine, and twenty-six in Washington. The existence of large forest reserves suitable for the manufacture of pulp was primarily responsible for the location of the industry in these regions. Spruce, Eastern and Western Hemlock, and Southern Pine among the conifers, and poplar, birch and maple among the hardwoods are the most important woods used in pulp and papermaking today.

The principal types of wood pulp may be classified in terms of manufacturing process as follows:

A. Mechanical or Groundwood Pulps

B. Chemical Pulp
   1. Sulphite (Bleached and Unbleached)
   2. Sulphate(Bleached and Unbleached)
   3. Soda

Mechanical or groundwood pulp is produced by reducing wood to fibres by a mechanical grinding process. This type of pulp is an important ingredient in such papers as newsprint, boards, catalogue paper, tissues, poster, etc., where permanence and strength are of minor importance, but where absorbency, bulk, and opacity are the chief characteristics desired.

In the manufacture of chemical pulps, the logs are first reduced to chips, then subjected to chemical treatment in order to dissolve most of the ligneous binding material, leaving the fibre which may or may not be bleached before use. Depending on the raw material and the procedure used, chemical pulps produced range from soft or weak to strong. The soft pulps are used in printing and other papers where smoothness and softness are of importance, and the latter in wrapping and writing papers where strength is requisite. Besides their use in paper and boards, certain bleached and otherwise purified grades are used in the manufacture of rayon, plastics and explosives.

For the most part groundwood and sulphite pulps are produced in the New England and Middle Atlantic State, the Lake States, and in the Pacific Northwest; the sulphate process, on the other hand, has had its greatest development in the South where the vast resources of Southern Pine are being utilized.

The paper and pulp industry, in terms of value of invested property, ranks seventh in the United States. Assets in 1939 totalled nearly $2,500,000,000. Investment per wage earner is high, totaling approximately $14,000 per worker. In this respect the industry ranks second; only the chemical industry exceeds it. According to data collected by the American Paper and Pulp Association paper mills with integrated pulp units have an investment of $49,500 per ton of daily productive capacity, while the investment of mills without pulp units approximates $30,800 per ton of daily capacity.

There are in the United States in excess of 750 paper mills, some 200 of which have integrated pulp units. The remainder are

dependent upon purchased pulp for their operations. Paper mills are located in 37 of the 48 States. The papermaking States with the greatest number of paper mills located in each are indicated below:

New York	119
Massachusetts	88
Michigan	54
Pennsylvania	53
Wisconsin	52
Ohio	49
New Jersey	41
Connecticut	31
New Hampshire	30
Illinois	26
Maine	25

The South, with fewer mills but large production is growing in importance.

Total production of paper and paperboard in the United States during 1941 has been estimated by the American Paper and Pulp Association at 17,280,000 tons. This is the highest level reached during any year in the history of the industry. Paper production in recent years has been steadily mounting. The year of 1941, which saw paper production at 97.4% of capacity, was the fifth year since 1929 that paper production has attained record levels. The total for 1941 was 19.3% in excess of 1940 levels.

The table below indicates production by major grade classification for recent years.

Kind	1941 (Estimated)	1940*	1939*
	(Quantity (tons, 2,000 pounds)		
Aggregate	17.280.000	14,483,709	13.509,642
Newsprint, total	1.058,000	1,056,304	954,259
Standard (in rolls and sheets)		1,028,840	925,897
Other (special grades)		27,464	28,362
Groundwood printing and specialty papers, total	602,000	550,453	540,342
Hanging		142,278	116,781
Catalog		96,416	80,632
Other		311,759	342,929
Book paper	2,020,000	1,655,423	1,534,591
Text paper	13,000	11,065	12,339
Cover paper	28,000	26,944	19,401
Writing paper, total	735,000	599,452	594,594
Rag content		93,414	83,897
Sulphite bond		364,288	364,054
Other chemical wood-pulp		141,750	146,643
Wrapping paper, total	2,860,000	2,500,818	2,238,993
Sulphite		577,017	628,427
Kraft		1,583,695	1,281,034
All other		340,106	329,532
Tissue paper, total	870,000	761,712	665,723
Toilet		316,386	285,085
Towel		155,754	129,105
All other		289,572	251,533
Absorbent paper	154,000	129,410	121,717
Building paper	853,000	682,460	659,090
All other papers	67,000	60,120	63,625
Paperboards, total	8,020,000	6,449,548	6,104,968
Container boards		3,434,834	3,361,441
Folding boxboards (bending)		1,416,452	1,359,961
Set-up boxboards (non-bending)		898,549	865,485
Binders' board		25,606	28,054
Cardboard		53,783	58,874
Bristol board		70,474	79,474
Leatherboard		15,706	25,714
Pressboard		9,443	7,619
Building boards		179,443	114,505
Other boards		345,258	203,841

* Source: Bureau of the Census.

Paper imports during 1940 totalled 2,826,880 tons. Of this amount 2,762,538 tons consisted of newsprint from Canada.

Paper exports in 1940 while more than double the exports for the preceding year, represented only 4% of domestic production. Exports in 1940 totalled 578,248 tons at a value of $63,409,884; 1939 exports totalled 266,079 tons at a value of $30,213,240. The war in Europe was largely responsible for the increased export demand. The principal export markets during 1940 were the United Kingdom, Canada, South America, Africa and the Orient.

Based on recent Bureau of Census data the summary regional distribution of paper productive capacity by kinds is approximately as follows:

Newsprint—Maine 39%, New York 17%, and Washington 13% of national capacity.

Wrapping and Bag Paper—The South is now the dominant region in these grades producing over 70% of the domestic total.

Kraft Board—The South is the principal production area, although substantial capacity also exists in the Lake States and on the Pacific Coast.

Jute Board—Ohio, Indiana, Illinois, Michigan, New York, and New Jersey have over 70% of the total capacity of these grades. Plants are located close to centers of waste paper supply.

Book and Writing Papers—70% of the capacity lies within overnight travel distance of New York City.

Tissue and Crepe Papers—90% of the productive capacity lies within 500 miles of New York or Milwaukee. New York and Wisconsin have 27 and 28 percent, respectively, of national capacity.

The three major channels for paper distribution are:—

1. Through the wholesaler.
2. Direct to converting mills which remanufacture into consumer products.
3. Directly to the large consumer such as printing and publishing houses.

The channel of distribution used varies with the type of paper in question. Newsprint paper is normally sold direct to the publisher on a contract basis. Printing papers, likewise, move in largest volume direct to the publishers, although substantial quantities are sold through wholesalers and directly to paper products manufacturers. Writing papers are sold chiefly through wholesalers and to converters who manufacture boxed stationery and similar products. Wrapping paper distribution is by a variety of methods; Southern kraft wrappings are usually shipped North to large paper converters and sales may be directly through the paper mill sales force, sales agents, and to a small extent through wholesalers; other wrapping papers are, in general, manufactured close to consumer markets and depending upon the kind of paper, distribution may take place by any of the three major methods. Paper boards are used chiefly for remanufacture into paperboard products, and are almost wholly distributed directly from the paperboard mill to the converter.

The rapid development of the paper industry during the last decade is due in large part to the expansion movement in the South. The increased demand for kraft wrapping paper and boards for packaging purposes has been primarily responsible. While the progress in other grades has been relatively normal, wrapping paper and board production in the decade from 1930 to 1940 increased at an amazing rate. In 1930 the total daily capacity of paper mills in operation in the South was 3,424 tons. By 1935 this capacity had been expanded, largely by new construction, to 4,678 tons, an increase of 37%; at the beginning of 1940 the capacity stood at 9,840 tons, 187% over 1930 and 110% over 1935.

The grade structure in the paper industry is exceedingly complex. Paper is used for

an ever-increasing number of purposes, and as a consequence there are thousands of paper grades and an infinitely greater number of paper products manufactured from the primary product. "The Dictionary of Paper," published by the American Paper and Pulp Association in 1940, has proved a valuable aid to operators and consumers in clarifying the grade structure of the industry.

Processing

The principal operation in paper making is the reduction of wood to pulp. A typical wood is about 50% fibre—the desirable part for paper making—while the rest, mostly lignin and resin, is useless for pulp-making. Not only must the fibre be separated out, however, but it must be shaken loose and then prepared so that it will intertangle to form the necessary mat. This latter is the paper-making process proper.

The industry has so many resemblances to steel making that a comparison may make it more easily understood by people familiar with the better-known steel industry. In the first place its typical operations are similarly conducted on a gargantuan scale. To compare with the huge strip ore-mining operations of the steel industry, the typical paper company must have huge forest resources, spreading in some cases over hundreds of thousands of acres; and incidentally paper companies usually find it advisable to conduct cutting and replanting operations so as to produce their raw materials in the form of recurrent crops.

The Paul Bunyan scale of operations continues from the lumber through the finished paper. For example the "digester" in which the wood is typically reduced to pulp, is a three story metal affair, the "blast furnace" of the paper industry, in which a charge of about 7½ tons is subjected for from three to five hours to chemicals and steam to pressures up to 125 pounds to the square inch. From here it moves to what can almost be called the equivalent of the refining process, in which everything but the fibre itself is washed away with the copious use of water—another point in which the industry resembles the steel industry, which also uses vast amounts of water. The final paper-making process is carried out on something remotely resembling the continuous rolling of strips and sheets, with water again plentifully used and the unfinished paper moving at speeds up to 1200 feet a minute. Lastly, the industry is in some cases integrated so completely that the material is almost continuously in process from the moment the logs rumble up the chute to the grinder until the paper roll comes off the final drying calendar ready for slitting and final preparation.

Moreover, paper-making, like steel-making, requires close chemical control throughout. In fact the main process, the reduction of the wood chips to pulp, is usually a chemical reduction process on a huge scale; the chemicals used must be carefully measured, handled in huge volumes, and for economy's sake carefully recovered for re-use.

Lastly the industry, like steel, is highly skilled. For the most part the heavy work, including conveyance of the materials from process to process, is mechanical, a paper mill being a tangle of conveyors, pipes and tubes, while the processes require such careful control, and errors are so expensive, that skilled men predominate throughout the plant.

Like many heavy industries such as steel and oil, the industry consists of both integrated and unintegrated units. Some plants carry the wood clear through to the paper; others carry it only to the pulp, just as some companies produce only crude oil or ore concentrates, then selling and shipping it to the final fabricator.

Both integrated and unintegrated companies, however, have a heavy investment in relation to the value of the product; and

the overhead costs are so great that the temptation is continually to cut the price in order to get volume. The industry, therefore, tends to fall in the prince-or-pauper class; for it tends in a few years to get over-built, due to the rapid progress of the art of paper-making and to the great economies to be achieved by newer methods and larger-scale operation. Persistent price weakness then develops, discouraging new installations until the steadily growing demand catches up with existing equipment and it takes some time for new equipment then to be installed. The vagaries of the business cycle make it well-nigh impossible for the industry to plan its way out of this cycle.

Logging operations are methodical; smaller trees are left and the ground is not encumbered with slash to prevent new growth. Transport of logs to mill is often a problem; this is why many mills are located at waterside, again like many steel mills and oil, non-ferrous metal and sugar refineries.

The logs are generally cut about five feet long and up to 18 inches across. For some processes seasoning of several months is necessary; for others, particularly in the South, no such inventory of logs is needed and the logs roll directly from rail, truck, or barge up the conveyor into the plant.

They first go to the barking drums—large revolving steel barrels with steel ridges, which fray off the bark from the tumbling logs. Then they go to the chipping machine, where they are quickly reduced to small chips about the size of large postage stamps and the thickness of heavy cardboard. This is done by forcing them against a revolving surface in which heavy knives are set something like the blade in an ordinary carpenter's plane.

Out of the chips are sieved the sawdust, bark particles and other refuse, and the clean chips travel another long conveyor up to bins in the top of the digester house. In some plants the sieving and the conveying are done at the same time, the covered bridge conveyor having an upper belt carrying chips to the chip bin and a lower belt carrying the waste to the furnaces. Incidentally, practically all unwanted parts of the wood, as they are shed in succeeding operations, are used as fuel for the boilers.

The wood is now ready for conversion into pulp, which in most mills is done with chemicals in the digester.

There is, however, an older and cheaper mechanical process. The wood is not even chipped to begin with, but the log is forced slowly against what amounts to a revolving grindstone, specially roughened and water-sprayed. Pulp so made, of course, keeps practically everything in the wood, including the lignin, etc., on the elimination of which so much care is lavished in the other processes. It is therefore of poorer quality, and is used in such short-lived products as newsprint and cheap wallpaper; and, mixed with some chemically made pulp, in some book papers and in box-lining grades.

A "semi-chemical" process also came into use in the 1920's, in which the chemical reduction is carried only part-way, after which the rest is done mechanically in an "attrition" mill. This is chiefly an economy process to save on chemicals.

But most pulp is made by the chemical digester process without mechanical reduction. Most paper gets its trade designation from the process used, and the process is determined by the choice of chemicals.

The sulphite process is the oldest important chemical process. It is used chiefly for spruce, firs, and hemlock — the long-fibred, non-resinous woods. The "cooking liquor" is calcium bisulphide. The product bleached, goes into bond and ledger papers, tissue, toilet and cleansing papers; book papers and into glassine, greaseproof and other wrapping papers. An increasing amount is going into rayon and cellophane. Unbleached, the product is mixed with the mechanical ground-

wood pulp above mentioned, for newsprint and some book papers.

The "kraft" or "sulphate" process has come rapidly into vogue in the last generation, particularly in the South, for whose woods it is particularly suited. It has the advantage that it can be used equally well for resinous and non-resinous woods. The cooking liquor is a mixture of caustic soda (sodium hydroxide) and sodium sulphide. The liquor is much weaker than in the sulphite process, so that cooking takes much longer; but on the other hand much of the cooking liquor can be reclaimed and reused.

There is also a less-used "soda process," usually restricted to short-fibred deciduous woods like poplar, cottonwood, gum, white maple, birch, and willow, and to rags and straw. The cooking liquor is largely caustic soda.

The digester is charged from the top; the chips are run into it by gravity from the bins. A digester is a retort some 50 feet high, with a conical base. They are often built in batteries, and the floor of the digester-house sets around the necks of the digesters. It takes about 20 to 30 minutes for the chips to fill up the digester. Then a pipe from the measuring tank of the cooking liquor is opened and just the right amount of liquor run in. The big cap is then bolted and live steam introduced until the temperature in the digester goes up to 345° F. and a steam pressure of 100 pounds develops. These figures may vary for processes. Here it is held for several hours until test samples show the cook is completed.

There is a pipe out of the bottom of the digester which runs up to the top of a "diffuser." When its valve is opened the pressure sends the whole cook through this pipe to the "diffuser."

Here the steam is run off to the boilers for re-use. The cooking liquor is washed or drained out. In the sulphate process this liquor, as drained from the diffuser, contains also all the lignin, pitch, resin, and impurities. This whole mess is run into an evaporator and concentrated down to about the consistency of fuel oil. Then it goes into a "recovery furnace." The heat is used and the soda is reduced to a molten smelt which flows from the bottom of the furnace into a tank and dissolves. Known now as "green liquor" it is piped to a settling tank and causticized. Even the bottom sludge after the causticizing, mostly lime, is recovered and burned in rotary lime kilns.

Meantime the pulp is washed and rewashed with hot water and finally discharged into a "stock chest."

If the pulp is to be bleached, the process takes place from here. The bleaching agent is generally chlorine; but other oxidizing agents are sometimes used.

Beating and "jordaning" of the pulp correspond to the refining of metals. Beating is done in a "hollander." This is an oblong open tub with rounded ends (like a huge bath-tub) and enough of a partition in the center so that the pulp can be forced to flow round and round the tub. On the way round it has to flow between a cylinder and a bedplate and between them they cut, "broom," and split the floating fibres to the desired degree. Bunches of fibres are broken up, and the fibres are brushed out and "fibrillated" so that they will enmesh more readily when made into paper. It is frequently said that paper is made in the beater, also that certain qualities of the paper are directly dependent on how long the beating is continued.

Other ingredients are usually added to the pulp in the beater, including color, sizing, and other non-fibrous materials. The loading is there added in the form of chalk, talc, clay or other mineral substance to fill in and smooth the final surface of the paper. Sizing, generally rosin soap, is added to enable the paper to take ink without spreading it. Coloring, also added in the heater, is now usual-

ly aniline, preferred for the range of shades as well as for cheapness.

The "Jordan" further reduces and prepares the pulp. In mills making tonnage grades such as newsprint and kraft papers the beating is often dispensed with, and the whole pulp-reduction operation is done in the Jordan.

Now the pulp is ready to become paper. It is pumped to the machine head box where the amount that will go to the machine is carefully controlled. The pulp going to the machine flows through rotary suction screens where all dirt too large to pass through .010 of an inch perforations is removed. The stock is here diluted to 1% fiber and 99% water. The flow of this dilution is made even across the screen by passing over a series of baffles. It is then released through an opening known as the "slice" which is opened or narrowed to determine final thickness of the paper.

It flows out onto the most peculiar, important, and long-established piece of machinery used in paper making — the "fourdrinier wire." This is a continuous wide belt of very close-meshed wire, with about 50 to 75 strands to the inch, moving rapidly away from the "slice" at rates as high as 1,200 feet a minute, and jiggling rapidly from side to side. As the watery pulp or pulpy water flows along, the water seeps fast down through the wire, and the jiggling mats the pulp out evenly.

By the time the mixture has been carried as far as the fourdrinier wire goes, the consistency has increased to about 30% pulp and 70% water. The wire then rolls under and moves back to the beginning as a continuous belt, and the pulp, now for the first time strong enough to carry its own weight, makes a slight jump over to the presses. Here it passes through pressing felts, which further squeeze out and absorb the water. In fact this whole operation, from the "wet end" of the fourdrinier wire as the water and pulp start their trip, down to the final roller, is designed to get the water out while permiting the pulp to mat and dry into paper and be given the desired finish and bulk. There are even, as in the "couch roll" at the "dry end" of the fourdrinier wire, suction pads to draw water out.

From the presses, the speeding pulp, now rapidly becoming paper but still very wet, passes through the "drying section," which consists of as many as 60 dryer rolls, the paper being held against them by a moving band of felt, being, as the felt band also is, doubled down and up from one heated roll to another. Finally it reaches the "calender stack," a bank of highly polished cylinders one under the other; the paper is woven in and out between them, starting from the top down, getting finally ironed and coming off into a reel. When a reel is completed it is taken off and trundled away to be unwound and slitted, then prepared for market.

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Paradichlorobenzene

PARADICHLOROBENZENE is a volatile, white crystalline material with a penetrating odor. It is generally familiar in the form of deodorizing blocks and moth preventatives in flake, pellet, and block form. Prepared by the controlled chlorination of benzene, the paradichlorobenzene is separated from orthodichlorobenzene by pressing, the ortho compound being a liquid.

Production of paradichlorobenzene in 1940 totaled 15,086,726 pounds, the output of eight plants. In 1939, production amounted to 15,796,756 pounds, with six plants making the material. Sales in 1940 were 14,165,109 pounds, valued at $1,207,143; and in 1939 were 15,577,113 pounds, valued at $1,452,-198. Paradichlorobenezene is packed in a wide variety of commercial containers. Steel drums varying from 25 to 200 pounds are used; as are barrels varying from 5 to 300

pounds, and cases containing various numbers of 10, 5, and one-pound cans.

The price of paradichlorobenzene in recent years has been from 11 to 12¢ per pound, depending upon the quantity contracted for.

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Paraffin

PARAFFIN is a hydrocarbonous product, derived from crude petroleum, of crystalline structure, usually white in color, with a melting point ranging upward from 115° F. It is extracted from certain crude petroleum by distillation, refrigeration and purification by sweating, acid treating and clay filtering. The United States produced 676,480,000 pounds in 1941, more than half in the Atlantic Coast States. This is about as much as the rest of the world produces annually. The uses of paraffin are many and varied, including wax paper, food packages, single service milk containers, candles, carbon paper, cosmetics, electrical insulation and many other special applications. It is especially important in connection with munitions manufacture, being used by the government for chlorination and waterproofing. Marketing is in bags or barrels. Prices vary with the grade, location, market, etc. Transport is usually by rail and motor truck. It will last indefinitely if stored at temperatures below the melting point. Paraffin wax is now marketed quite generally under three classifications, namely: crude scale, semi-refined and full refined wax. The chief differences are color, odor and oil content. Crude and semi-refined tend to degrade in color when exposed to light and air. Substitutes are in the experimental stage as this is written. The United States import duty is 1¢ per pound.

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Patchouli Oil

PATCHOULI, or patchouly oil, is a yellow to brownish, odorous, viscid liquid obtained by distilling the dried leaves of shrubby mint, Pogostemon patchouli, which is cultivated in India, the Philippines, Java, Sumatra, and Singapore. The oil darkens and improves with age. In addition to the oil distilled in the East Indies, a certain amount of the leaves were in the past also shipped to France, England, and this country for distillation. The East Indian oils were generally of "ordinary" or "medium" grade; while European and domestic oils are labeled "special" and "extra special."

Imports of patchouli oil into the United States in 1940 totaled 38,410 pounds, valued at $155,399. The Netherlands Indies supplied the greatest amount, 31,739 pounds; with British Malaya the second largest supplier, with 3,380 pounds. In 1939, imports amounted to 28,242 pounds valued at $59,979. Netherlands Indies in that year shipped 15,060 pounds to this country; British Malaya, 9,095 pounds; and France, 2,471 pounds. Commercially patchouli oil is packed in 25-pound tins, with aged varieties packaged in smaller five-pound tins.

The price of patchouli oil on June 1, 1942 was about $9.50 per pound. On January 1, 1942, it was $5.50; and a year earlier, the same.

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Peanut Oil

PEANUT OIL is a "vegetable" oil obtained from crushing peanuts. Georgia is the principal peanut-producing State, and the Southeast states account for over 50 percent of total United States production, which approaches 2 billion pounds. A foreign import duty of 4½¢ per pound on unshelled peanuts and 7¢ on shelled peanuts, imposed in 1930, halted the imports of peanuts, except those coming duty-free from the Philippines. In 1941, production of peanut oil expanded in sensational fashion, amounting to 150 million lbs. in crude form and 137 million lbs. of refined.

Peanut oil is used mostly for frying; is an excellent substitute for olive oil, and for some purposes is rated considerably better. Under ordinary conditions only low grade peanuts are used for oil but under a favorable price relationship, it is reasonable to assume that all grades of peanuts would be made available for crushing into oil. As "crude," it is marketed usually in tank cars, and as "refined" in ½ pint to 5 gallon cans, 55-gallon drums and tank cars. A ceiling price of 13¢ per pound has been placed on crude oil while the price of refined oil varies. If kept from light and air it keeps indefinitely. While there is only one principal grade of crude, there are two main types of refined oil—white and yellow. The war's interruption of imports of foreign oils has widened the demand and possible use for peanut oil. The import duty is 4 cents per lb.

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Peanuts

The nutlike seed of the Brazilian herb known as the peanut plant. Production in the United States is controlled by allotment plan, but the limited quotas do not apply to peanuts for crushing into oil.

Leading producing nations are British India, China, United States, Nigeria, and the Netherlands Indies. In the United States, peanuts are grown in three main areas. The Virginia-Carolina Area consists of Virginia, North Carolina and Tennessee where the Virginia type is grown. The Southeastern Area, which produces more than half the nation's crop, contains the states of Georgia, Florida, Alabama and small parts of South Carolina and Mississippi. Georgia is the largest producing state in the Union. The Southwestern Area consists of Oklahoma, Texas and small parts of Arkansas and Louisiana. The Spanish and Runner types are grown in the latter two areas.

A small proportion of Virginia type nuts are graded for size and reach the consumer in the shell, usually in roasted form. Most of these are sold as Jumbo Handpicked and Fancy Handpicked Peanuts. Extra Large Virginia Shelled Peanuts are used principally for packing of Salted Peanuts, although Medium Virginia Shelled are used for this purpose to some extent. This grade is also used for candy manufacturing. No. 1 Virginia Shelled are used chiefly for Peanut Butter, but also to some extent for candy. Spanish and Runner Shelled are used principally for Peanut Butter, although some Spanish are marketed as Salted Peanuts and they are also used by candy manufacturers.

About 50% of all peanuts are used in candy and other confectionery, 25% go into peanut butter, 12% are sold as salted peanuts, 8% are sold at ball parks, circuses, etc., as unshelled peanuts and 5% are used for miscellaneous purposes such as the manufacture of drugs, etc. During recent years, the government has bought large amounts of peanuts that have been converted into oil.

Peanuts are marketed in bags of from 100 to 125 pounds. Price varies in accordance with market conditions, although growers are guaranteed a minimum price in connection with the quota plan of production. Virginia farm stock is traded in pound units, Spanish and Runners mostly on per ton basis, with the bushel unit used in some sections.

Cleaned and shelled goods are sold on a per pound basis.

The largest peanut markets are in Suffolk, Va., Dawson, Ga., and Ft. Worth, Texas. At these points are located large processing plants which prepare the peanuts for market. In Georgia and Texas the processing plants are more scattered, being located in small towns and, in some cases, at country crossroads. Of recent years, however, the trend has been to place processing plants in small cities, such as Suffolk, Va.,

and Albany, Ga., which are located in the heart of the peanut belts.

The peanuts are usually hauled to the processing plants in trucks. There is one marked difference in the method of handling farmers' stock peanuts in the different areas. In Virginia the farmers run the peanuts from the peanut pickers into bags averaging about 90 pounds each. The peanuts are handled and stored in these bags. In Georgia and Texas Territories, however, all farmers' stock peanuts are handled in bulk. The peanuts are run from the pickers into closed-bodied trucks and from the trucks into large bins in the peanut warehouses. After the peanuts are prepared for market, the greater part are shipped out by rail, although trucks have been hauling a steadily increasing percentage in recent years. Steamships also are used.

Peanuts are never sold direct from the producer to the small retailer. They pass from the hands of the grower to the processor or miller, where they are cleaned, shelled, graded, and shipped to manufacturing plants to be salted or manufactured into peanut butter or confectionery. The peanut product manufacturers then sell their commodities to wholesalers or jobbers who in turn sell to the retailers. This is simply an orderly process of marketing.

Owing to the risk of weevil and worm infestation shelled goods should be carried in cold storage—this commodity is not considered perishable except for that fact.

Principal types or grades are: Virginia, Spanish and Runner types. Customary standard grades of the Virginia type—Jumbo Handpicked, Fancy Handpicked, Extra Large Shelled, Medium Shelled, No. 1 Shelled, No. 2 Shelled.

Spanish type—No. 1 Shelled, No. 2 Shelled.

Runner type—No. 1 Shelled, No. 2 Shelled.

There is a duty of 4¼ cents per pound on unshelled and 7 cents per pound on shelled peanuts.

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Pecans

THE pecan is the smooth oblong thin-shelled nut of the pecan tree. The market is supplied by growers in this country, with commercial production centering in Georgia, Alabama, Carolina, and Texas. The new crop appears on the market in November, and pecans, a holiday item, are sold largely in the period November 1-January 1. Principal varieties are paper-shell and Schley, the latter being sold usually in its normal state because its shell is too thin for the bleaching and polishing operation.

Pecans are marketed in both shelled and unshelled form. They find their commercial use largely in the confectionery trade, and are used to some extent by bakers, mostly for "topping" for fancy cakes and pastries. The bulk of the crop is distributed through grocery and fruit trade channels to consumers.

Commercial grades for pecans-in-the-shell are: Medium seedlings, large medium, fancy large bleached, and extra fancy large bleached. The nuts, except the Schley variety, are bleached and polished, with the paper-shell the top quality. Shelled pecan grades are Light Amber Pieces, Fancy Pieces, Fancy Medium Halves, Fancy Toppers, and Large Halves.

The unit of purchase from the producer is the pound. Nuts-in-the-shell are packed in 50 and 100 pound bags and in 25-pound wood or fibreboard boxes; the shelled product is packed in 5, 10, 25, 50, and 60 pound wood or fibreboard cases.

The pecan crop in 1941 total 86,201,000 pounds, as compared with 88,426,000 pounds in the previous year.

Pecans are subject to decay and weevil infestation and require cool storage. They

may be safely shipped either by rail or by truck.

July, 1942, market values, per pound, were: Unshelled, Medium polished seedlings, 14½ cents; large medium bleached and polished, 15 cents; fancy large bleached and polished, 16½ cents; extra fancy extra large bleached and polished, 17½ cents; Shelled: —Light Amber Pieces, 31 cents; Fancy Pieces, 38 cents; Fancy Medium Halves, 40 cents; Fancy Toppers, 40 cents; Large Halves, 41 cents.

Import duties are 10 cents per pound for shelled and 5 cents per pound for unshelled.

Pecans are not under the provisions of the General Maximum Price Regulation.

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Peccary Skins

See Pigskins

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Pectin

PECTIN is a water-soluble methylated pectic substance occurring in plant tissues or obtained by restricted treatment of protopectin with protopecinase, acids or other reagents. Pectin is white and amorphous and is found in or obtained from fruits, succulent vegetables, etc. It yields viscous solutions with water and when combined with acid and sugar in proper concentration yields a jelly which is the basis of fruit jellies. It is largely a by-product of apple and citrus processing.

Pectin is used principally in the manufacture of jellies and jams, and comes in both liquid and powdered form for such purpose. The liquid is packed in 5-gallon cans, 2 cans to the case, while the powdered is packed in 100 to 200-lb. drums. The trading units, respectively, are gallons and pounds. For sale to consumers for home jelly making, both the liquid and powdered pectin are packed, in 6 to 9 ounce containers.

Currently, several prominent pharmaceutical manufacturers are experimenting with pure pectin, in powdered form, as a component of special drug products.

Pectin may be shipped by either rail or truck, and requires cool storage.

The July, 1942, wholesale market ranged 70 to 80 cents per pound for either apple or citrus pectin, in drums. Quotations on the liquid are unavailable, and are generally made on a contract basis between producer and commercial user.

Citric acid may be used as a substitute for pectin for some purposes.

The import duty is 25 percent.

Pectin comes within the scope of the General Maximum Price Regulation.

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Pennyroyal Oil

TWO varieties of pennyroyal oil are encountered commercially. European pennyroyal oil is a yellow, sometimes reddish oil showing a blue or green fluorescence, obtained by distilling the plant Menthe pulegium. American pennyroyal oil is also yellow in color, but is obtained from the leaves and tops of Hedeoma pulegoides, which grows natively in considerable abundance in North Carolina, Tennessee, and Ohio. Both oils have a mint-like odor and are used in medicine and as insect repellents.

Commercially the pennyroyal oils are packaged in 50-pound tins. On June 1, 1942 the domestic oil was nominal pricewise, since stocks were low. The imported oil at that time was priced at $2.90 per pound. At the beginning of 1942, the American was $2.50 and the European $2.40 per pound. At the corresponding time in 1941 the prices were $3.00 and $2.25 per pound, respectively.

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Pepper

The use of the word pepper is often applied confusedly. Real pepper is the black pepper plant, whereas so-called red peppers or cayenne is a capsicum belonging to a different family. We are, therefore, concerned only with black and white pepper, and here again misunderstanding among laymen often exists between these two. White pepper is made from black pepper that has been more highly cultivated for the purpose. This can be readily seen by cutting a black pepper berry in half, which will show the inner white layer. The black pepper plant is a climbing vine somewhat comparable to the grape vine. It is produced by planting cuttings six feet apart each way. During its life it is supported by a live tree—by a sturdy hardwood post. In the Lampong districts of Sumatra, the largest producing area for black pepper, all work is done by natives.

The pepper berries being the fruit of the vine, grow in spike-shaped clusters and turn from green to red and then dried. Usually the sun drying method is followed by spreading them on matting—to prevent adulteration with dirt. During this process the pepper is frequently turned with a rake to prevent mould. Sometimes the pepper is dried by the smoking method. After drying, natives separate the stalks from the fruit by pressing them underfoot. A great deal of this work in the field is done by women and children working for the husband and father.

The final stage at point of production has now been reached, but before bagging and shipping, the pepper is carefully cleaned. The United States government some years ago imposed high quality standards on all pepper imported in this country and as a result The Netherlands East Indian government followed by imposing export regulations for even higher quality, both of which are strictly enforced.

In contrast to the native production of Lampong black pepper, white pepper production is highly cultivated, due to the necessity of obtaining a larger black berry from which the white pepper is derived. In fact, it is more comparable to estate production. Whereas in the Lampong districts the Chinese usually act as the middlemen between the natives—to whom they often advance money against his crop—and the European exporters, they appear as the producers of white pepper in the Muntok gardens in the Island of Banka, where the largest white pepper crop is grown.

It is usually estimated that white pepper costs approximately 40 to 50 per cent more to produce than black.

Whereas the fruit of Lampong black pepper vines is picked before it turns red, this fruit remains somewhat longer on the vines until completely ripe, which facilitates the process of making white pepper. This is done by soaking the fruit wrapped in large bags in water from eight to ten days, preferably in running water such as streams, although open water holes are more commonly made for this work. When the skins —or outer layers—are sufficiently loose and soft the pepper is put into tubs where it is stamped underfoot in a little water and washed until all the skins, pulp and stalks are detached. The white pepper berries are then taken out of the tub and dried in the sun on mats. Decortication, as this process is called, is also done at times by machinery in the spice mills in England and this country.

Pepper (black and white) is grown mainly in The Netherlands East Indies, the Malabar section of India, British Borneo (Sarawak), French Indo China (Saigon) and Siam, the largest production being in the order named. India, with an annual production of 20,000 tons, consumes most

of the pepper it produces and the other production areas are of limited importance marketwise. The Netherlands East Indies as producers are of predominant importance in determining the world price of the article. About 40,000 tons annually are produced there. Four-fifths of the production of pepper in The Netherlands East Indies consists of Lampong black pepper. French Indo-China produces about 3,500 tons.

World consumption holds stable at about 65,000 tons of which the U. S. uses 15,000 tons annually.

In addition to the household, kitchen and dining room table, the meat packing industry, the canning industry, the pickling and condiment industries, are all important users of pepper which leads all other spices in commercial uses. In the food industry, pepper does not compete with any other article, nor has it any substitute. The armed forces use large quantities of pepper. Per capita consumption is larger than that of the civilian population.

The marketing unit is the pound. The price in 1942 was 6½ cents a pound, the same as imposed by the government's ceiling December, 1941. Pepper is shipped in bags by steamer from the country of origin to the U. S. It is not perishable and keeps in good condition indefinitely. There is no duty on pepper.

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Peppermint Oil

PEPPERMINT OIL is a colorless to yellow oil distilled from fresh, or sometimes partially dried leaves and flowering tops of Mentha piperita. It darkens on exposure to air. The oil is official in the United States Pharmacopeia, with the specification that it must contain at least five percent of ester calculated as menthyl acetate, and not less than 50 percent of total menthol, free and as esters. The principal source of menthol commercially is by freezing it out of peppermint oil.

Production of peppermint oil in the United States during 1941 amounted to 1,080,000 pounds. This amount was obtained from 33,480 acres of land in the states of Michigan, California, Indiana, Ohio, Washington, and Oregon. Michigan is the leading state as regards production, with St. Joseph county the center of the industry. The Pacific coast states are increasing their production steadily. The value of the 1941 crop of peppermint to the farmers was estimated at about $3,000,000. In volume, peppermint is the second most important oil produced in the United States. It is only exceeded by the output of turpentine from the Southern pine forests.

Early in 1942 considerable interest was focused on the possibility of extracting menthol from American peppermint oil. Before the war this country obtained most of its menthol from Japan, only a small amount having been produced synthetically in this country. With the war, however, Japanese material was shut off and the domestic synthetic manufacturers were unable to expand sufficiently rapid, because of lack of both plant facilities and raw materials, to meet a continuing total demand. Attention was therefore turned to menthol from domestic oil, since the price of menthol had advanced, or appeared likely to advance to a point where its extraction would be economically feasible. One large manufacturer of proprietary medicines using considerable menthol in a product, in fact placed an "educational" order for menthol to be extracted from domestic oil.

Foreign trade in peppermint oil is on both sides of the ledger. In 1940, imports of the oil totaled 67,085 pounds, valued at $110,-381. Of this amount Russia furnished 62,210 pounds; the United Kingdom 3,063 pounds, and Japan 1,209 pounds. In 1939 imports amounted to 51,460 pounds; valued

at $80,642; with Russia supplying 49,191 pounds, the United Kingdom 2,062 pounds, Holland 122 pounds, China 60 pounds, Italy 14 pounds, and Japan 11 pounds. Exports of peppermint oil from the United States in 1940 amounted to 315,830 pounds, and in 1939 to 396,073 pounds.

Domestic peppermint oil is packed for shipment in 25-pound tins and in 60-pound cases. It is offered in the natural oil, which is the product obtained on the first distillation; as a double-distilled, or redistilled oil; and as a triple-distilled oil. Each distillation improves the quality and value. Domestic peppermint oil is also offered in a terpeneless grade, double the strength of the oils containing the terpenes.

The largest use of peppermint oil is as a flavor, particularly in chewing gums and candies. It is also used as an odorant and in medicine. The price of domestic natural oil on June 1, 1942 was $5.50 per pound. At that time redistilled, U.S.P. oil was priced at $6.00 per pound. At the beginning of 1942 the natural oil was $7.00, and the redistilled oil $7.25 per pound. At the same time in 1941 the natural oil was $2.85, and the redistilled oil $3.00 per pound.

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Peppers

See Capsicum

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Perbunan

See Synthetic Rubber

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Perchlormethane

See Carbon Tetrachloride

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Perilla Oil

PERILLA OIL is derived from the seeds of the plant, Perilla ocimoides, found mostly in the Orient. It is light yellow in color, having an iodine value of about 200 and a saponification value of 191.

The perilla seed is very rich in oil content and the oil has fine drying properties. Upon drying, it produces a brilliant, tough, water-resistant film which is harder than that of linseed oil. Prior to the war, perilla oil ranked next to linseed and tung oils in importance as a drying oil and was used in the paint and varnish industries, linoleum and oilcloth and inks. Its main disadvantage was the tendency to form drops or globules when the varnish was spread on a hard surface.

The peak of consumption in the United States occurred in 1936 when 112.4 million pounds were used. Since that time, the trend has been lower and the contraction became most severe with the advent of war. In 1940, the consumption declined to 19 million pounds and in 1941, to only 8½ million pounds.

The price of perilla oil, drums, N. Y. averaged 24.6 cents per pound during May, 1942.

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Petitgrain Oil

PETITGRAIN OIL is a yellowish liquid distilled from the twigs, leaves, and unripe fruit of varieties of the bitter orange tree, Citrus aurantium (amara). It is produced in several of the South American countries, Haiti, and France, with the product of the latter country considered the better quality. A low grade oil has at times been distilled in Sicily also. The South American production is centered in Paraguay, Uruguay, and Argentina.

Imports of petitgrain oil in 1940 amounted to 256,380 pounds, valued at $272,842. Paraguay was the largest contributor with 240,291 pounds, Uruguay was second with 10,443 pounds, Haiti third with 3,761 pounds. In 1939 imports totaled 150,308 pounds, valued at $111,589. In that year Paraguay exported 136,110 pounds to the United States, Argentina 4,410

pounds, Uruguay 4,400 pounds, France 4,349 pounds, and Haiti 405 pounds.

Commercially, Paraguayan petitgrain oil is packed in drums of about 175 kilos and in cases containing 40 kilos, or in cases of 88 kilos. The French oil is packed in 5-kilo tins.

Petitgrain is used in perfumery. The price of Paraguayan oil on June 1, 1942 was $1.80 per pound. On January 1, 1942 the price was $1.70 per pound. A year earlier it was priced at $1.40 per pound.

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Petrolatum

PETROLATUM is a pasty mixture of solid paraffine hydrocarbons and mineral oils generally melting at 95° to 120°F. The wax content differs from paraffine wax in that the latter is crystalline, forming plate or needle shaped crystals, while petrolatum wax forms much smaller grainy crystals. It is produced from petroleum crude oils which contain petrolatum wax by means of cold settling of residual lubricating stocks, followed by conventional refining steps such as acid treating, clay filtration and blending. Naturally, it is processed in the principal refining areas, mostly in the east and middle west. Uses are in salves and ointments, shoe polishes and dressings, rust preventives, greases, leather dressings, fabric coating, coatings for interior of barrels and cans, rubber compounding and paper impregnation. The marketing unit is the pound with prices ranging from 3¢ to 15¢ per pound, depending on grade. Transportation is in barrels or smaller metal containers. When stored in original containers unopened, at reasonable temperatures, it remains in merchantable condition for several years. Principal types or grades—dark, red, amber, light amber, cream white, lily white, snow white, super white, white soft, yellow soft. These grades have more or less fixed price differentials. The first three are commonly used in industry and the other seven ordinarily used by pharmaceutical concerns. There are no general substitutes although for some purposes paraffine wax, lanolin, fatty acids or synthetic waxes may be used. The war did not interfere with production nor curtail consumption as of May, 1942.

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Petroleum

THE American petroleum industry popularly is regarded as merely the source of petroleum fuels and lubricants. Actually, it is a large and thoroughly integrated industrial enterprise which finds and produces its own raw materials, converts them into finished products, distributes the manufactured commodities, and carries on all the intermediate steps—exploration and discovery, storage and transportation, promotion and research, and development of techniques, process, and equipment. At the same time the petroleum industry supplies to many other industries the raw, semi-finished, and finished products which enter into the manufacture of countless commodities of which petroleum is a basic, essential, or contributing part.

In the popular mind, the raw material of the petroleum industry is crude oil. That idea once was correct. However, through the miracles of industrial chemistry the petroleum industry now has two really fundamental raw materials, the elements hydrogen and carbon, chief constituents of the infinite variety of chemical combinations which comprise the hydrocarbon family. Along with crude oil the petroleum industry produces natural gas, now a raw material from which an increasing number of commodities is being made. In the numerous methods of processing crude oil and natural gas the industry produces other products which are raw material for additional commodities.

At this point, it should be explained that the petroleum industry is an enterprise of unlimited variations. There is, for example, no typical "oil company." There are thousands of individuals, partnerships, and small companies which engage in one or several of the industry's basic operations—production, refining, transportation, and distribution—or in related activities, such as exploration, manufacture of equipment, research, development of processes, etc. On the other hand there are larger companies which engage simultaneously in several operations, and still larger corporations which can, and sometimes do, carry on all the functions of the industry.

Since there is nothing static about the industry, which constantly is in various stages of transition, operating conditions change with requirements. By and large, individuals, partnerships, companies, and corporations of the industry are acutely conscious of every change, and act and react as best their business judgment indicates.

Crude oil is produced in 23 of the United States, and in 30 other countries. The United States is by far the world's leading producer, having contributed more than 21 billion barrels, or in excess of two-thirds of the world's supply, since 1859. Annual production of the United States normally exceeds one billion barrels.

Crude oil flows or is pumped from hundreds of thousands of wells drilled in thousands of American oil fields, large and small. These wells tap reservoirs of porous strata, chiefly limestone and sandstone, lying as deep as 14,000 feet. While the wells are widely scattered, and not all the 23 states produce oil in commercial quantities, major producing areas have been grouped into districts for statistical convenience. These districts and the states which comprise them are:

Appalachian District—New York, Pennsylvania, West Virginia, Central and Southeastern Ohio, Kentucky, and Tennessee.

Lima-Indiana District—Northwestern Ohio and Northeastern Indiana.

Michigan District—Michigan.

Illinois-Indiana District — Illinois and Southwestern Indiana.

Mid-Continent District—Kansas, Oklahoma, Northern and Western Texas, Southeastern New Mexico, Arkansas, Northern Louisiana, Mississippi and Missouri.

Rocky Mountain District—Montana, Utah, Wyoming, Colorado, Northwestern New Mexico, and Utah.

California District—California.

Gulf Coast District — Coastal Texas and Louisiana.

Outside the United States the major oil-producing countries, in current rank of output, are: Russia, Venezuela, Iran, Netherlands East Indies, Rumania, Mexico, Iraq, Colombia, Trinidad, and Argentina.

The foreign oil trade of the United States is largely in exports of refined products. Currently petroleum exports have been reduced a full one-half by war. Some crude oil is imported, largely from South America, for processing and export of the finished products. A tariff of $1 per barrel, about the same as the market price of the domestic product, is imposed upon oil imported, except that brought in under bond for processing.

Crude oils produced from different fields—even from different wells of the same field—differ in characteristics. Broadly, oils are classified as paraffin-base, intermediate-base, and naphthene-base, the type being identified by the nature of the residue after processing. All three types of oil are produced in all districts, but the oils of each district generally are preponderantly of one type and these oils are named for the district, such as Appalachian for paraffin-base oils, Mid-Continent for intermediate-base oils, and California for naphthene-base oils.

Properties of the various oils largely determine the nature and quantity of refined

products which may be manufactured from them, and oils consequently are classified by the relationship between their hydrogen and carbon constituents as indicated by specific gravity or density. Specific gravities are expressed in fractions, or decimals, according to a degree scale developed through the American Petroleum Institute. The range is from ·5 to 65 API.

Customary crude oil is sold at the well by the producer to established purchasing agencies at quotations which are known as "posted prices." This term has carried over from the days when the principal purchasers of oil actually posted the prices in the fields and at refineries. The agencies purchase for the accounts of pipe-line operators or refiners largely on a continuous sale basis. They take the oil from the field tanks of producers and pay the price prevailing at date of delivery.

One-eighth of the crude oil produced is assigned to investors in producing operations or royalty owners. Normally, this "royalty oil" also is sold and the royalties paid in the form of cash.

About three-quarters of the oil produced in the United States is moved directly to refineries by pipe line. The rest is transported by railroad tank cars and by sea-going or inland-waterway tankships. The pipe lines are built and are operated by companies, and virtually all the tankships and nearly all the railroad tank cars also are owned either by transportation or operating companies within the industry. No one transportation medium alone can handle all the oil which must be moved.

Petroleum refineries, which convert crude oil into finished products, are located as conveniently to sources of supply, to transportation, and to markets as is possible. In some cases, small refineries are located near producing fields. In other cases, large refineries are built at sites adjacent to centers of consumption. The practical result is that the roundly 500 petroleum refineries in the United States are located in 35 different states.

These refineries differ greatly in size and type. Some handle 5,000, or less, barrels of oil daily. Others handle as much as 150,000 barrels daily. Some of the refineries, particularly the smaller plants, are equipped to produce one or only a few finished products. Others produce the gamut—motor fuel for motor vehicles, motor boats, and aircraft; fuel oil for domestic and industrial heating, power, and transportation; lubricating oil for automotive and industrial heat, power, and transportation; lubricating oil for automotive and industrial needs; road oils and asphalts for paving; solvents, detergents, drugs, creams, and medicinal products; light and heavy greases for lubrication; and other essential products to a total running into the hundreds. In some cases refining plants are built especially for the manufacture of certain products, such as toluol, essential constituent of TNT; glycerine, the drug; and synthetic rubber.

Hundreds of different refining processes are employed in making the products. Basically there are two types — distillation, or simple physical separation of the constituents, or "fractions," of crude oil, and cracking, or chemical rearrangement of the hydrocarbon molecules.

Such rapid progress is made in petroleum refining that within five years the most modern plant may face total or partial obsolescence. This rapidity of change makes exact compliance with other than minimum product specifications difficult since quality normally is ahead of requirements. For instance, regular inspections made by the U. S. Bureau of Mines, which tests gasoline in open market twice yearly, repeatedly have indicated quality is higher than called for in specifications.

From refinery to market, transportation, packaging, and distribution vary greatly. In the case of crude oil, the trade unit usually

is the barrel of 42 gallons. The finished products are sold in lots of tank cars, tank trucks, barrels, gallons, quarts, tons, pounds, and even ounces.

The distribution and marketing of petroleum products are wholesale and retail businesses in themselves. Refiners may sell at wholesale, or retail, or both. They may own and operate local bulk plants, located at every sizable community, which receive products such as motor fuels and lubricants and heating oils by tank car or tank ship, and distribute them by tank truck. Again, bulk plants may be owned and operated by wholesalers, or jobbers, who buy from refiners and provide their own transportation and storage.

Petroleum retailing actually begins with the receipt of products at roadside service stations. There are some 226,000 drive-in service stations, and around 180,000 other outlets, such as garages, parking lots, country stores, etc. More than 80 percent of the service stations are owned by independent marketers or individuals.

Price quotations vary with the quantity of products and the outlets. Gasoline quotations include tank car, tank wagon, dock and service station prices. All are published in the trade press. Tank car prices generally are recognized market prices, f.o.b. refinery or other shipping point. Tank wagon prices are quotations at which current sales are made from tank trucks to service stations or large consumers. Dock prices apply to deliveries at the terminal or refinery, the purchaser buying f.o.b. and providing transportation. Retail prices, plus taxes, are posted on gasoline pumps at service stations.

There are approximately 80 trade associations in the industry. Some are national, some sectional, and some state-wide. Some have broad general programs covering many of the petroleum industry's phases of operation; others concentrate on specific undertakings. In many of the oil-producing states there are one or more associations of producers. In practically all states there are state-wide and local associations of marketers.

Many of the industry's trade associations function as liaison agents between industry and government. Due to the constant improvement of the industry's products encouraged both by competition and by scientific progress, government safeguarding of quality has not been a serious problem. In making purchases of the industry, the government usually invites competitive bidding and publishes specifications which comprise largely statements of minimum requirements. In the field of production state governments are actively interested. A number of states have formed an Interstate Oil Compact Commission as a conservation agency designed to discourage wasteful operations in the production of crude oil. The industry works closely with federal and state governments in the collection of sales taxes, especially the retail taxes on gasoline.

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Phenol

PHENOL is also known as carbolic acid, and occasionally by the more specific chemical name of hydroxybenzene. Pure phenol is white and usually, in the form of crystalline masses. When not pure, or on having been exposed to light it may have become pink or red in color. Phenol is deliquescent and may in humid atmospheres absorb sufficient moisture when left exposed to dissolve itself.

The original commercial source of phenol was the middle-oil fraction of coaltar. Extraction was accomplished with caustic soda, followed by neutralization with a mineral acid or carbon dioxide, and distillation. It is now also produced synthetically by sulphonating benzene, forming benzenesulphonic acid and then fusing with caustic soda. The synthetic process now furnishes the larger portion of commercial requirements. Pro-

duction of phenol in the United States during 1940 totaled 96,155,080 pounds. Of this quantity, some 72,187,520 pounds were produced synthetically, and 23,625,053 pounds obtained from coal tar. In 1939, output totaled 68,577,421 pounds from both sources.

The most common grade of phenol encountered in commerce is the United States Pharmacopeial grade, which is at least 98 per cent pure. A liquefied phenol is also official in the U.S.P., containing 88 percent phenol and 10 percent of water. Crude and technical grades of synthetic and natural origin are also available for industrial consumption. Commercially, the material is shipped in tankers, 475 and 200 pound drums, and 5 and one-pound bottles and tins.

The most important industrial use of phenol in recent years has been the manufacture of synthetic plastics of the phenol-formaldehyde type. It is also used in the manufacture of many pharmaceutical preparations and disinfectants, being a powerful antiseptic and germicide in its own right. Numerous important chemical compounds, including salicylic acid, picric acid, synthetic tannins, photographic chemicals, dye intermediates, perfume chemicals, and plasticizers, also call for phenol as a reagent in their synthesis. It also serves as a selective solvent in refining lubricating oils. The price of phenol during the first half of 1942 was 11½¢ per pound, at the works, when purchased in tanker quantities. On January 1, 1941, the comparable quotation was 11¢ per pound.

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Phenolformaldehyde Resin

See Plastics

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Phenol-Furfural

PHENOL-FURFURAL is a synthetic resin produced in liquid and pulverized form—thermosetting. It is a reaction product of phenol and furfural. Principal use is as a bond in the production of synthetic resin moldable products comprising various fillers such as woodflour, asbestos, mica and paper and cloth in either disintegrated or in sheet form. This product is sold in standard fifty-gallon drums on a pound basis, drums weighing from 235 to 350 pounds. Prices vary with the type produced. The product is under allocation by War Production Board Orders M-25 and M-27. Marketing is in liquid form in various grades of viscosity and in pulverized form with and without fillers to meet particular requirements. In the war production field it is important in the production of munitions and ordnance parts, tools, metal fabrication, etc. Other uses are as a bond in the production of grinding wheels, and in the manufacture of incandescent lamps, etc.

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Phenolfurfural Resins

See Plastics

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Phenolic Resins

See Plastics

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Phenylacetamide

See Acetanilide

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Phenylformic Acid

See Benzoic Acid

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Phosphoric Acid

THE term phosphoric acid in commerce indicates the material known chemically as orthophosphoric acid, conforming to the formula H_3PO_4. It is a colorless, sparkling

liquid or transparent crystal, depending upon the concentration of the acid and the temperature. The 50 and 75 percent acids at ordinary temperatures are limpid liquids; the 85 percent material is a syrupy liquid; while the 100 percent acid exists in a crystalline state at temperatures below 39.8° C., and liquefies above that point.

Two methods are employed in the manufacture of phosphoric acids. Impure grades of the acid are made by the older method, in which phosphate rock, which contains a large percentage of calcium phosphate, is mixed with sulphuric acid, heated with steam and stirred. Calcium sulphate precipitates and is filtered off, leaving a filtrate containing considerable phosphoric acid. Large electric blast or open furnaces are employed in the more modern production of the acid. Phosphate rock is smelted with coke in such furnaces to produce vapors of phosphorus. The air oxidizes the phosphorus to the anhydride, phosphorus pentoxide, which is mixed with steam to produce phosphoric acid.

Ten plants in the United States during 1939 produced 76,912 tons of phosphoric acids, calculated on a basis of 50 percent orthophosphoric acid. The production was valued at $3,035,333. In 1937 the output of the same number of plants amounted to 39,125 tons, valued at $1,785,785. Phosphoric acid is usually sold in technical and pure food grades containing 50 or 75 percent of acid, in United States Pharmacopeia grades containing 10, 50, and 85 percent of phosphoric acid, and in a C.P. grade containing 85 percent. The acid is packed in containers varying in size from a one-pound bottle to tankcars. Carboys and wooden barrels are most generally used.

The principal use of phosphoric acid is for the preparation of the various phosphates. In addition, considerable amounts of the acid are consumed in the food industry, as a substitute for tartaric and citric acid in jellies, flavors, and soft drinks; in the engraving and lithography fields; in textile manufacturing; and in the manufacture of fertilizers. The 50 percent pure food grade of phosphoric acid on June 1, 1942 was quoted at $4.00 per 100 pounds in barrels and tankwagons. This price had been in effect for some months. The 85 percent U.S.P. acid, having a specific gravity of 1.710 has been quoted at 12¢ per pound, in 180 pound carboys, throughout 1941 and during the first half of 1942.

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Phthalic Anhydride

PHTHALIC ANHYDRIDE occurs as white, crystalline needles, having a characteristic odor. It is produced at the atmospheric oxidation of naphthalene in the presence of a catalyst. Vanadium oxide is most often used as the catalyst, and the oxidation performed at around 500° C. The crude phthalic anhydride is then purified by sublimation.

Production of phthalic anhydride and phthalic acid in the United States during 1940 totaled 57,946,415 pounds, and in 1939 amounted to 44,274,430 pounds. Sales in 1940 were 28,346,067 pounds, valued at $3,899,151; and in 1939 were 20,380,004 pounds, valued at $2,785,372. Six producers operated during 1940, and five in 1939. Phthalic anhydride is packed in kegs weighing 100 pounds and in fiber drums and barrels containing 80, 175, and 200-pounds.

The largest use of phthalic anhydride is in the production of the phthalic resins, in which it is reacted with glycerin, and in making phthalic acid esters. It also finds considerable use in the manufacture of phenolphthalein, and other phthaleins. In recent years, phthalic anhydride has been selling at around 15¢ per pound.

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Pickled Sheepskins

See Sheepskins

Pignolia Nuts

THESE edible nuts are kernels of the seed of a pine nut that grows in Spain, Italy and Turkey. There are no satisfactory statistics on production. Principal uses are as salted nuts and for fancy confectionery and bakery purposes. The normal marketing unit is the case of 110 lbs. However, supplies have been unattainable due to the war. The commercial types are named after the country of origin. The duty is 5 cents per lb. and substitutes are, of course, other shelled nuts.

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Pigskins

PIGSKINS of various types are used for making a number of important leathers.

Only a small percentage of the pigs slaughtered in the United States, and a slightly higher percentage of the pigs slaughtered in other countries, are skinned to provide raw stock for the tanning industry. This is due to the fact that the carcass of a pig is difficult to handle and keep clean when it is skinned, on account of the greasy layer of fat covering the meat; the skinning is a difficult process because there is no distinct division between skin and fat and the skin cannot be pulled off the carcass as with other animals. Furthermore, cuts of meat, such as bacon, hams, etc., sold with the skin left on, are easier to handle and the skin commands the same price as the meat which is, of course, much higher than the price it would bring as leather raw stock.

Because of the difficulties surrounding the skinning of a pig, the animal is seldom as cleanly flayed as most other animals and the skin is frequently cut and blemished in the process.

Pigskin strips cut from pork loins are used for making leather for shoe insoles, counters, and welting. Sport shoe upper leathers, shoe trimmings, leather novelties, luggage, wrist watch straps, razor strops, wallets, and other products are made from the same kind of pigskin leathers as those used for shoe uppers.

Pigskin glove leathers are made from common pigskins, from the skins of wild peccary boars which are found principally in Central and South American countries, and from the skins of the carpincho, which is not a pig but a South American water rodent. The skins of the peccary and carpincho make a very soft and fine grained leather and are in steady demand for making fine glove leathers.

Most pigskin shoe leathers are vegetable tanned, most glove leathers are chrome tanned, and a small quantity are alum tanned to produce a white glove leather.

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Pig Iron

See Iron and Steel

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Pilchard

See Sardines

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Pimento Oil

PIMENTO, or allspice oil is a fragrant, yellowish-brown liquid obtained by distillation of the dried unripe fruit of Pimenta officinalis. A pimento-leaf oil, similar to the berry oil, obtained from the same species of tree is also a commercial product. Both oils are produced in the West Indies. Jamaica is the center of the industry. The name allspice is derived from the fact that the odor of the oil resembles clove, with a suggestion of cubebs and nutmeg.

The pimento-berry oil on June 1, 1942 was priced at $6.75 per pound; while the leaf oil was $4.00. At the beginning of the year the berry oil was $4.25, and the leaf

oil $2.25 per pound. At the start of 1941 the price of the berry oil was $4.35, and that of the leaf oil $2.50 per pound.

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Pimientos

ORIGINALLY the Guinea pepper, the pimiento is now the Spanish paprika, a spicy aromatic pepper prepared from the flesh of smooth-skinned, red ripe varieties of the large sweet pimiento pepper. While imported from Spain and Italy before the war, our supplies now come largely from California and Georgia, with Cuba latterly shipping in large quantities of canned pimientos in small-sized containers, which may no longer be packed in this country under the WPB tin conservation order.

The pimientos are shipped in 400-pound barrels in brine for use in the manufacture of cheese and relish manufacture, are distributed to some extent in fresh form through produce channels, but have been largely canned. They are packed into cans without either water or brine and are similarly packed in glass. The packing season runs August to November in Georgia and September to December in California.

They are canned practically whole, government grading requiring that each must be not less than 2 inches in length and width when flattened, with smaller pieces labeled "Pieces". Under war restrictions they may now be packed only in No. 2, 2½ and No. 10 tins, and the pack is limited to 50 percent of the 1940 pack, which was about 500,000 cases.

The trading unit in commercial buying is the pound. Prior to the tin restriction order they were packed largely in 4, 7, 15, and 28-ounce tins, and the trading unit was the dozen cans.

July, 1942, market values were $1.60 per dozen for 4-ounce tins and $1.95 per dozen for 7-ounce tins; other sizes are off the market until the 1942 pack is ready for marketing.

Fresh peppers are a suitable substitute for pimientos.

Import duties on pimientos are 6 cents per pound on prepared, preserved, or canned.

The processed pimientos come under the restrictions of the General Maximum Price Regulation.

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Pine

See Southern Pine

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Pineapple

THE pineapple is an agave-like plant originally native to tropical South America, now widely cultivated in the tropics, with the principal commercial production in Hawaii, Puerto Rico, and Cuba. It has rigid, spiny, margined, recurved leaves and its fruit consists of a succulent fleshy inflorescence which ripens into a solid mass, invested with tough, persistent floral bracts and topped with a tuft of small leaves.

In fresh form, pineapples are imported from Cuba and Puerto Rico, and to a limited extent from Mexico, and are sold by the crate, with the fruit graded as to size. Most imports are sold at fruit auctions. The fruit is highly perishable, requires cool storage, and prompt handling.

The commercial market is dominated by canned pineapple, which ranks with peaches at the top of the list of quantity of fruits canned. Practically all canned pineapple for the domestic market comes from Hawaii with limited imports from Puerto Rico and Cuba and, prior to the war, from the Philippines and Formosa.

Inasmuch as pineapples will not ripen after picked, the canned product is far superior to the fresh in markets at any distance from the actual point of growing.

Total world production of canned pineapple in 1940-41 was 15,602,391 cases, of which 11,055,491 cases were packed in Hawaii, 30,000 cases in Cuba, 1,072,900 cases in the Philippines, and 85,000 cases in Puerto Rico. Australia and British Malaya pack pineapple in a limited way.

The trading unit for the canned product is per dozen. Principal grades are fancy and standard, and the fruit is packed in sliced, crushed, and juice form. Prices for 1942 pack for principal sizes and grades were: Fancy 2½ sliced, $2.15; standard $1.95; No. 10 (per half dozen) $7.75 for fancy and $7.35 for standard; fancy crushed 2½s $2.15; No. 10 fancy crushed (per half dozen) $7.00; Fancy juice, No. 2 $1.15; 46-ounce $2.75; No. 10 (per half dozen) $5.50, all prices being f. o. b. Honolulu. Under WPB regulations, the 1942 pack may not exceed 1940 production, and shipments are irregular, due to hostilities in the Pacific.

There is no outright substitute for pineapple.

Import duties are 1⅛ cents each for fresh pineapples in bulk, 35 percent for candied, crystalized, or glace pineapple, 2 cents per pound for preserved or prepared pineaple, and 70 cents per gallon for pineapple juice.

Fresh pineapples do not come under the General Maximum Price Regulation; the canned product does.

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Pine Gum

See Turpentine and Rosin

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Pineneedle Oil

SEVERAL pineneedle oils are offered commercially. An oil obtained from Pinus montana, known as oil of dwarf pineneedles is official in the United States Pharmacopeia. It is colorless, has a mild balsamic odor, and should contain five percent of esters calculated as bornyl acetate. Another pineneedle oil is obtained from Pinus sylvestris. A third pineneedle oil is derived from abies sibirica, and known as Siberian pineneedle oil. It is colorless or pale yellow with an aromatic odor. Still a fourth pineneedle oil is produced from Abies alba in Central Europe. Except for the Siberian oil now known as Fir Needle oil, the main commercial sources for these products are Austria, Czechoslovakia, Yugoslavia, and Italy.

Pineneedle oil imports in 1940 totaled 150,920 pounds, valued at $121,310. Russia was the largest supplier of the oil, with 121,549 pounds; Japan next with 26,320 pounds; and Italy third with 2,521 pounds. Perhaps significant in the 1940 imports were 520 pounds brought in from Australia, since this country may become a larger supplier as war shuts off other sources. In 1939 pineneedle oil imports amounted to 116,734 pounds, valued at $92,707. Russia contributed 106,202 pounds in that year; Japan 3,594 pounds; Yugoslavia 2,756 pounds; Italy 1,593 pounds; and Germany 1,041 pounds.

Commercially, Siberian pineneedle oil is offered in drums containing 400 pounds and tins holding 50 pounds. The oil from Pinus sylvestris is also packed in 50-pound tins. The dwarf pineneedle oil is packaged in 25-pound tins. The perfumery and medicinal fields are the consumers of pineneedle oils. The price of the Siberian oil on June 1, 1942 was $3.00 per pound. On the first of the year it was $2.60 per pound; and on January 1, 1941, $1.30 per pound.

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Pine Oil

PINE OIL is produced as a liquid, light straw color to water white (specific gravity 0.933/0.939 at 15.5°C.). It is processed from Southern Pine wood and stumps in the Southern belt states. Production averages

about 115,000 barrels (50 gallons to the barrel) annually. Its principal uses are in mining (flotation process), and in textiles, disinfectants, paints and varnishes, chemicals. It is marketed by the gallon—usually being transported in 55-gallon drums but also in tank cars. Recent prices range from 65¢ to 90¢ per gallon. It is not perishable, in fact the quality improves with age for certain uses. Two principal grades are: Light straw color and white (dehydrated).

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Pine Tar

See Turpentine and Rosin

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Pine Wood Naphtha

See Turpentine and Rosin

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Pinene

See Turpentine and Rosin

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Pitch (Pine)

PITCH is a residual material obtained in the destructive distillation of Pine wood, or by direct distillation from rosin. It is produced in the Southern belt States but no accurate statistics are available on the quantity. Its production is fairly substantial, however, and sufficient to cover any anticipated future need. It is used mostly in caulking compounds for wooden ship construction. It is usually marketed in packages of about 200 pounds gross; and transported in steel drums or wooden kegs. Recently, the "package" price ranged from $6.00 to $6.50. It is not perishable. Principal grades are: Pure Pine Pitch or compound with Coal Tar. Substitutes are Coal Tar Pitch and Harwood Pitch. For purposes of tariffs, it is classed as "Rosin" and there is a United States duty of 5 percent.

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Pitch (Pine)

See Southern Pine

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Pitchblende

See Uranium

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Plastics

The following article was prepared by the Society of the Plastics Industry, Inc.

History

THE terms, plastics and plastic materials do not lend themselves to simple or accurate definition. They consist of many types of compositions which may be formed into innumerable shapes and then processed to retain such shapes under a wide range of conditions. They are alike chemically in that they are large organic molecules of high molecular weights.

Plastic materials are generally classified loosely into two types depending upon their reaction to heat. First, thermoplastics which soften when sufficiently heated and solidify upon cooling. This results in no chemical change and may be repeated indefinitely. Second, thermosetting materials which first soften when sufficiently heated but when heated further and put under pressure change chemically. Therefore, the reaction is not reversible.

Most of the chemical compositions used in plastic compounds have been scientifically known for many years. However, their adaptation as satisfactory industrial plastic materials, with few exceptions, has developed only within the last thirty-five years. Since then growth in the field has been a marvel of industry.

In 1869 John Wesley Hyatt discovered a method of working with a cellulose nitrate-camphor mixture in a solid form and the

first plastic composition was born and introduced as "Celluloid." This material, a thermoplastic, was found to possess valuable commercial properties and so became the pioneer of the plastics industry.

The use of a natural resin, shellac, as a plastic also developed at this time but had limited application for nearly twenty-five years.

About 1910, considerable experimenting on heat resisting compositions resulted in the production of the plastic types known as cold molded.

At about the same time, the first thermosetting resin, phenol formaldehyde was produced by Dr. Baekeland and was marketed in a plastic material called "Bakelite." The original patents granted Dr. Baekeland covered the formation of the molding compounds, including the use of fillers, the technique for using heat and pressure to convert the resins into infusible, insoluble products, and the preparation of solutions for impregnating fibrous sheets into laminated products.

Casein was introduced in the United States about 1920. This material being hygroscopic tends to warp in our climate so its applications have been limited.

Considerable activity in the development of new plastic materials took place around 1927 and several groups of worth while and valuable materials have since been produced.

Perhaps, the most interesting characteristic of many of these later resins is their eye appeal. They are transparent, translucent and available in unlimited colors, which led to increasing public interest and acceptance of fabricated plastic articles.

Cellulose acetate, the first of the improved cellulose group, appeared in 1927 possessing properties which led to its use in place of the inflammable cellulose nitrate.

The first of the alkyd group, used primarily for protective coatings, appeared in 1926. At the same time the ureaformaldehyde resins were introduced. They were thermosetting and quickly proved to be a welcome addition to this field.

In 1928 the cast phenolic resins were made available. While not a new chemical composition, being produced from the same ingredients as the older phenolic formaldehyde types, they differ greatly in appearance and methods of processing.

Since 1930 vinyl resins have become available and new members and applications are continually being developed.

The first Acrylic resin appeared in 1931. Cellulose acetate butyrate, the first cellulose mixed ester compound, and Ethylcellulose, the first cellulose ether type, arrived in 1932. Polystyrene compositions were produced in the United States in 1937. Lignin and Melamine were introduced in 1939.

Since then new types and improved adaptations of existing types have appeared at the rate of one or more a year. Constant research assures a continued production of better plastic materials which will open richer and wider fields for their application.

In the formation of plastic materials the plastic resin or chemical compound is generally used in conjunction with other ingredients which modify or improve certain characteristics. Such ingredients are dyes, fillers, lubricants, pigments and the highly important substances known as plasticizers.

Dyes and pigments are used to obtain the thousands of color combinations so important to the eye appeal and utility of the finished product. The success of this operation calls for careful consideration of the chemical composition of the dyes, resins and other ingredients as well as the conditions under which the products will be formed and utilized.

Lubricants such as various waxes, soaps and graphite are used to increase bearing properties and prevent sticking during molding.

Fillers are used to obtain properties not inherent in the resins themselves. The choice

of filler depends upon the characteristics desired. They are divided into two groups, organic and inorganic or inert fillers.

The organic fillers are usually wood flour, pure cellulose, cotton or other vegetable fibres or shredded fabrics. They are used to improve the strength and appearance and to lower the cost of the finished product.

The inorganic fillers are usually asbestos, mica, silica, and various inorganic substances. They improve the heat and chemical resistance and electrical properties of the products.

Plasticizers are a wide variety of organic compounds, usually esters, used to increase the plasticity of the compounds. They may also impart definite desirable characteristics such as water resistance. Plasticizers are so important that the utility of plastic materials depends to a large degree on the selection of the proper type and amount of plasticizing agent.

The plastic industry, in common with most other industries, has been greatly handicapped since the war program originated by the shortage of raw materials. The demand from all sides for the basic chemical compounds used in formulating plastic materials and plasticizers has continually expanded, and critical shortages have ensued. This shortage has resulted in restrictions being placed by the governmental agencies on various materials limiting their use chiefly to war applications and essential civilian demand.

During the past year a series of WPB preference rating orders have been issued restricting the use of thermosetting materials, cellophane, chemical cotton, styrene, ethel cellulose, thermoplastic materials, plasticizers and molding machinery. These broad restrictions tend to limit the use of plastic materials for the duration of the emergency to war and essential civilian purposes.

Molding and Fabricating Methods

Products made of plastic materials, in their many applications and present price range, would not be possible were it not for practical methods of fabrication such as the art of molding. Many plastic compositions with interesting possibilities are of no commercial value as no method has yet been devised for their economical or practical processing.

Mold and die designing requires considerable skill and experience on the part of the designers and tool makers. The cost of operation, strength of the product, and the life of the molds are important economic factors which must be considered.

There are four general methods of molding used namely, compression, injection, transfer molding, and extrusion as well as several methods of laminating. Various adaptations and minor methods are used and the casting of phenolics has become important in recent years.

The method selected depends on several factors, chief of which are the materials to be processed, the size, shape, design, cost and number of desired parts.

Until recently it has been the general practice to mold the thermosetting materials by either compression or transfer methods and the thermoplastic materials by either injection molding or extrusion. There are numerous variations in the design of the presses and in many cases principles or features of both types are combined.

COMPRESSION MOLDING is the oldest and from the standpoint of actual poundage fabricated the most widely used method. It is used principally for thermosetting materials but thermoplastics may also be molded and usually are when the part desired is larger or heavier than the capacity of injection machines allows.

Compression molded thermosetting materials are usually preformed and then placed directly into heated steel molds. The mold is then closed, heated, and pressures of from 1,000 to 8,000 pounds per square inch are applied. The resin first softens and flows into the mold cavity where it cures into a

solid, permanent form. The mold is then opened and the piece either manually or automatically ejected.

The early presses, while semi-automatic, called for considerable manual attention such as loading the material and cleaning the mold for each operation. Several machine companies have introduced fully automatic machines in the last few years. These are important advances which eliminate human errors and mold an excellent product.

TRANSFER MOLDING while designed for use with thermosetting materials is in principle an injection molding process. The reason thermosetting materials do not lend themselves to standard injection processes is that they cure rapidly upon the application of heat and cannot be kept in a plastic state long enough to be molded successfully in injection machines. This difficulty is overcome in transfer molding by placing the material in a heated chamber attached to the compression machine. The heated material becomes partly plasticized and is forced thru small orifices or sprue into the molds. Here it is shaped and cured by the application of heat and pressure. As the material flows readily the destructive effect of high pressures on fragile inserts and pins is lessened. It is also possible to mold coarse filler materials so that little flash results and relatively thin sections may be obtained.

INJECTION MOLDING presses are fully automatic and provide for economical production of thermoplastic parts. The material in exact amounts is preheated in a heating cylinder. The resulting viscous mass is forced under pressure thru a nozzle into a die of one or more cavities. The die is closed under pressures of between 10,000 and 30,000 pounds per square inch for a few seconds to set the material. The press then opens and the piece is ejected and the cycle is repeated.

The use of injection machines is only about ten years old and the number of machines and their capacity have continued to increase.

EXTRUSION is chiefly used in the fabrication of casein, cellulose compounds, vinyls and styrene resins. Material in the form of grains, powders or continuous ribbons is automatically fed into a heated cylinder. The viscous mass produced is then forced by screw or hydraulic pressure thru dies which form continuous sheets, rods, tubes or an unlimited number of cross sectional shapes.

The speed of extrusion is regulated to obtain proper forming pressure and the die nozzle is long enough to allow for curing of the resin. This is an economical method as the dies are not costly and are easily made and no doubt will be adapted to processing thermosetting materials.

LAMINATING. Large amounts of synthetic resins in the form of solutions are used in laminating processes. Layers of fabrics, fibres, paper, wood, or combinations of such materials are saturated with heat reactive resins such as the phenols or ureaformaldehydes. Pressure and heat are then applied to the built up layers and a hard homogenous mass is obtained. These products may be obtained as rods, tubes, sheets or special shapes and can be drilled, sawed, punched or threaded.

The amount of bonding pressure and its method of application are highly important. Standard laminated sheets, rods and tubes are molded, between steel sheets or platens under high pressure.

In the molding of special and compound curved shapes required in many aircraft applications, two general techniques, namely, high pressure and low pressure methods, are used. The part to be shaped is placed in a mold and the pressure applied by rubber bag, sand bag, shot or other mediums.

In general low pressures are considered to range from just sufficient pressure to force intimate contact between the laminae upward to 75 lbs. per sq. in. High pressures are

considered to range from this point upward to several hundred lbs. per sq. in.

There is considerable difference of opinion as to the merits and limitations of both methods and to a large extent the proper technique depends upon the shape, required physical properties, and use of the finished part.

Low pressure molded articles are generally considered easier to make but being of lower density have less moisture resistance and lack some of the strength characteristics of high pressure molded parts. High pressure molded products can be made with smoother surfaces and possess better electrical and moisture resisting properties.

ADHESIVES. One of the many applications of both phenolic and urea resins is in the form of adhesives which are generally considered to be superior to the older types of glues.

The growth of the plywood industry has been aided to a large degree by the availability of these strong waterproof bonding agents.

The phenolic resin adhesives are excellent for industrial purposes but as they tend to discolor with age they are not used for decorative purposes.

The urea resins do not have this characteristic and furnish a hard surface with color fastness so are better suited for such applications.

Semicured heat reactive resins are used and are available in so called hot or cold setting types. With the hot type the resin is polymerized into its insoluble form by the application of heat and pressure. With the cold type an added catalyst enables their use at room temperatures. Dry mixtures of powdered resin and catalysts which can be mixed with water for immediate use are also available.

The plastic materials most widely used and most important commercially are acrylics, alkyds, cellulose acetates, cellulose acetate butyrates, cellulose nitrates, cold molded, ethyl celluloses, lignins, melamines, phenolformaldehydes, phenolfurfurals, polystyrenes, proteins, ureas and the vinyl resins.

ACRYLIC RESINS

Acrylic resins are formed when the various monomeric derivatives of acrylic acid are polymerized. They have been known chemically for many years but became available in commercial quantities only about 1930 after extensive research and development.

The various resins in this class range from soft viscous semi-liquids to hard thermoplastic solids but the harder types are the ones chiefly used as plastic materials. Perhaps the best known member is methyl-methacrylate, which was introduced in 1936.

Chemically these resins are ester derivatives of acrylic or methacrylic acids and are commercially produced from ethylene or propylene obtained from petroleum. Methylmethacrylate is prepared by converting acetone cyanohydrin into alpha-hydroxyisobutyric acid esters and dehydrating the hydroxyl ester. The polymerization must be carried out by careful control of catalysts and oxidizing agents.

Among the characteristics of these materials having industrial interest are colorability, dimensional stability, optical properties, rigidity, and transparency.

The present producton of acrylic resins is practically all used for war applications, chiefly in aircraft. Transparent cockpit enclosures, windshields, windows, gun and observation turrets, lenses and various parts requiring transparency, weather resistance and other properties of the material.

Forms in which available: molding granules and powders, sheets, rods and tubes.

Commercial applications: adhesives, aircraft windows, dentures, leather finishes, lenses, protective coatings, illuminating medical and industrial instruments, reflectors, signs and various decorative articles.

Alkyd Resins

Alkyd resins are a class of resinous ester compounds formed by the reaction between various organic acids and alcohols. They are readily soluble and when modified with certain drying oils form excellent lacquers.

Alkyd resins were first developed around 1900, but were not manufactured cheaply enough to acquire wide commercial applications until about 1925.

While used to a minor extent in molding and as binders, their greatest utility is in protective coatings for automobiles and refrigerators. Such large amounts are used for these purposes that alkyd resins now rank second only to the phenolics from the standpoint of volume consumption in the plastics industry.

They are formed when polyhydric alcohols such as glycerol, various glycols or sorbitol react with polyhydric acids such as abietic, linolenic, phthalic and maleic acids to form esters which are readily polymerized.

When fortified with a urea formaldehyde or melamine formaldehyde resin, rapid drying enamels of superior durability, hardness and color stability are obtained.

Alkyd resins have been found of great value in the war effort. The use of these resins in protective coatings for the superstructure of naval vessels, ships, tanks, barracks and a multitude of minor uses has created such a demand, coupled with a shortage of raw materials and modifiers that practically no civilian supply is available.

Forms in which available: various air drying resin solutions.

Commercial applications: paints, varnishes and enamels for exterior surfaces of automobiles and refrigerators, decorative articles and furniture.

Casein

Casein is a phospho-protein in combination with calcium phosphate and constitutes about 3% cows' milk. It is the only protein type plastic material used in any commercial quantities, although some other forms are available.

Originally developed in Europe some forty years ago, casein plastics were first manufactured in the United States about 1920.

Casein is obtained by treating milk with a precipitating agent, usually rennet. After processing, dyeing and shaping, the product is hardened in a formaldehyde solution and an insoluble, tough, hornlike substance is produced.

Investigations of this reaction indicate that cross linkages probably take place within the protein polymers. The material hardens slowly and may take weeks depending upon the thickness of the product. Wide applications of casein have been limited as it is difficult to mold and, being susceptible to moisture, tends to warp or crack. Casein can be highly colored and polished and being relatively cheap is chiefly used in the button trade. Other known casein material sources are soybean protein and zein, obtained from corn.

Forms in which available: disks, rods, sheets and tubes.

Commericial applications: buttons, beads, games, novelties and trim.

Cast Phenolic Resins

Cast phenolic resins are compounded from essentially the same ingredients as molded phenolics but differ widely in appearance, method of processing and commercial applications.

This method of manufacture was considered for some years but it was only after considerable research that suitable materials for casting became available in 1928. While methylmethacrylate and polystrene have recently been cast with various degrees of success, the cast phenolics are the most important.

Cast phenolic resins are prepared by mixing phenol, formaldehyde, plasticizers, lubri-

cants and dyes in steam heated kettles for various periods of time up to twenty-four hours. The honey like, viscous substance formed is then poured at a relatively low temperature into lead molds of the desired shape. After the castings have set they are removed and cured by heating in ovens. The length of curing time depends upon the product being formed but usually takes several days.

Success in preparing cast phenolic products depends upon carefully regulated and supervised conditions. Improper timing may result in the destruction of a batch while discoloration of the dyes is apt to result from careless curing. It will be noted that the cast phenolics differ from the molding materials in that no fillers are used.

Cast phenolic products have a gemlike appearance of considerable beauty in an unusual range of colors. In fact, they have been used to replace semi-precious jewels as it is possible to match the depth and quality of colors found in the natural stones.

Cast phenolic sheets may be obtained by slicing from large slabs of the material or may be cast between plates in thickness up to one inch.

Other properties of interest are non-inflammability, lack of taste or odor, and resistance to moisture. They may be easily machined to close tolerances and shrunk on metal shafts.

The finished moldings are usually tumbled or buffed to bring out the maximum lustre inherent in the materials.

Development work on the use of cast phenolics for special war purposes is proceeding along several lines. The use of cast phenolic dies, replacing metal, for shaping aluminum aircraft parts and the development of acid and water resistance containers might be mentioned.

Forms in which available: blocks, sheets, rods, tubes, cements, liquid resins for casting and special castings.

Commericai applications: advertising signs and displays, jewelry, lighting fixtures, novelties and various automobile, radio, electrical and household parts such as cases, handles, housings, knobs, machine parts, etc.

Cellulose Acetate

Cellulose acetate is another member of the cellulose ester family. In its case the cellulose is acetylated by the action of acetic anhydride. It initially became of interest industrially during the first World War when it was used as a non-inflammable coating on the wings of aircraft. Facilities for its production were available after this conflict and continued research led to the development of cellulose acetate rayon.

In 1927, this member of the cellulose class of thermoplastic materials was introduced in the form of sheets, rods and tubes. In 1929 it was made available as a molding compound.

Cellulose acetate plastic materials are produced by treating purified cotton linters with a mixture of acetic anhydride, glacial acetic acid and sulphuric acid. This reaction is completed in about six hours and a viscous mixture results. After precipitation and drying the cellulose acetate is obtained as a white flaky mass known as acetate flake. This flake must be mixed with plasticizers, dyes, and lubricants to obtain the commercial plastic materials.

There are a large number of plasticizing agents which may be used, each imparting its own qualities to the final product and a wide range of physical characteristics is obtainable by the use of different or combinations of different plasticizers.

The resulting plastics are not true chemical compounds but rather collodial or solid solutions of cellulose acetate in various plasticizers.

Possessing greater heat stability, mechanical toughness, impact strength and better self welding properties than cellulose nitrate, it

has replaced the latter in many applications such as photographic film, goggles and tool handles. It has exceptional strength and good appearance and may be obtained in a variety of rich colors.

Widely used in laminating glass prior to 1938, it has since been replaced by vinyl butyral, a superior product for this purpose.

Cellulose acetate has many commercial applications which find use in War materiel particularly as metal substitutes. In addition it is used for transparent cockpit enclosures, windows, coverings for maps, documents, etc. The lenses, eye pieces, Y tubes and valve guards for many gas masks are made of this material. It is used for partitions, blackout sheets and many smaller parts such as knobs, handles, buttons, instrument dials and gauges, and panels in various branches of the service.

Forms in which available: molding powders, granules, flakes, sheets, rods and tubes.

Commercial applications: airplane cockpit enclosures, automobile steering wheels and accessories, radio, refrigerator and telephone parts, lighting, kitchen and bathroom fixtures, fishing equipment, lenses for gas masks and goggles.

Cellulose Acetate Butyrate

Cellulose acetate butyrate is a mixed cellulose ester similar in appearance, methods of production, properties and uses to cellulose acetate. It was introduced as a protective coating in 1932 and a molding compound was placed on the market in 1938.

Chemically, cellulose acetate butyrate is formed by the action of a mixture of butyric and acetic acids and anhydrides upon cellulose. Its properties can be varied by altering the percentages of acids, degree of hydrolysis, and plasticizer content.

It has greater weather resistance, lower moisture absorption and better adhesive properties than cellulose acetate and has replaced the latter recently in applications where these properties are of value. Its compatibility with a greater number of solvents and plasticizers is also advantageous.

Cellulose acetate butyrate has entered into the war program thru various applications. Lamps, lenses, handles for brushes, substitutes for various trim and hardware, and parts where low moisture absorption and impact strength are desired.

Forms in which available: flakes, molding granules and powders, and sheets.

Commercial applications: automotive parts, fishing equipment, refrigerators, radio and bathroom fixtures, outdoor uses as weatherstrippings, handles, etc.

Cellulose Nitrate

Cellulose nitrate is formed by the nitration of cellulose whereby the hydroxyl groups of the cellulose are replaced by nitrate groups from nitric acid. Cellulose nitrate, or pyroxylin is the oldest synthetic plastic material. It was developed by Hyatt in 1870. Several commercial applications were soon found for this material and it was fabricated into many different articles in constantly increasing volume.

While highly flammable and unstable to light its many unique properties have enabled it to continue as an important commercial product.

As the pioneer plastic material cellulose nitrate contributed greatly to the development of fabrication methods, markets, applications, and research for the entire synthetic plastics industry.

Chemically, cellulose nitrate is prepared by the action of nitric acid in the presence of sulphuric acid upon carefully purified cotton or wool cellulose of a high alpha cellulose content. It is generally agreed that the complex cellulose molecule is made up of glucosidic units, each unit having three hydroxyl groups for possible esterification. However, the reaction does not occur in a uniform manner and so the degree of nitration

is expressed in the percentage nitrogen content of the material. The composition used in plastics contains about 11% nitrogen. Great care must be exercised during its preparation because of its high flammability.

The compound is thoroughly washed and mixed with a solvent, such as alcohol, dyes and a plasticizer. Camphor is generally used for the latter. A dough like mass results which is rolled, baked, and polished into commercial forms.

Among the properties that led to wide commercial use of cellulose nitrate are its flexibility, strength, water resistance, ease in fabricating, transparency and colorability.

However, cellulose nitrate presents difficulties from the molding standpoint. It is not heat stable enough to be injection molded and, being a thermoplastic material, it can not be economically compression molded. In addition, unlike other thermoplastics, the granules do not form a strong weld when molded.

Recent improvements have been made in the heat and light stability of this material and it is now far superior to the original product but the high point in its popularity has probably passed.

Cellulose nitrate is used in war materiel for transparent sheets for windows, enclosures and coverings. Many smaller parts such as tabs, name plates, dental strips, tooth and shaving brush handles, etc. It is also used in ammunition as wads and augmenting charges.

Forms in which available: rods, sheets, tubes, lacquers and emulsions.

Commercial applications: airplane windshields, bag frames, buckles, brushes, handles, pens, piano keys, toys, novelties, drafting instruments, eyeshades, coverings, etc.

Ethyl Cellulose

Ethyl cellulose, a cousin of cellulose nitrate, was the first cellulose ether of commercial value to be made in this country. Its use as a plastic compound was patented in 1917 and it became commercially available under various trade names between 1935 and 1939. At first, it was chiefly employed in the adhesive, protective coating and wire insulation fields but recent applications include extruded shapes and package wrappings.

Ethyl cellulose differs, chemically, from the other cellulose base plastic materials in that it has an ether rather than an ester structure and its strength is derived from this type of linkage.

It is prepared by treating cellulose obtained from cotton linters or wood pulp, with a strong sodium hydroxide solution. The alkali cellulose formed is then treated under carefully controlled conditions with ethyl chloride or sulphate. After washing and distillation ethyl cellulose is obtained.

Various ethyl cellulose compositions can be made by the addition of different plasticizers, a large number of which are compatible.

Ethyl cellulose finds various direct and indirect applications in the war effort. It is used in extruded wire coatings, electrical appliances, wrappings for food and various articles, coatings and laquers.

Forms in which available: flakes, molding powders, sheets, and extruded shapes.

Commercial applications: automotive radio and refrigerator parts, electrical appliances, furniture, jewelry, paints, lacquers and coatings.

Cold Molding Compounds

Cold molding compounds are powder combinations of various binders and fillers which may be shaped under pressure, at ordinary temperatures, and later cured in heated ovens. This type of plastic material first became industrially important in 1909 when a composition using bitumen as a binder was introduced.

These compositions were developed to fur-

nish low cost, heat resisting materials for use in electrical apparatus and for some twenty years were widely utilized for such purposes. More attractive, stronger materials have to a large extent replaced them, however, in recent years.

Cold molded compositions generally consist of about 70% filler and 30% binders and are of three general classes depending on what binder is used, namely:

1. Bitumen base non-refractory compositions.
2. Phenolic resin non-refractory compositions.
3. Inorganic binder refractory compositions.

The filler content is usually asbestos mixed with small amounts of slate flour, clay or barytes etc., together with an oxidizing agent.

The bitumen binders used are formulated from a mixture of different organic oils, asphalts, coal tars, natural or synthetic resins, stearine or vegetable pitch and solvents in varying percentages.

When phenolic resin binders are used the filler is usually mixed into a cold liquid solution of the resin and the part then fabricated.

The inorganic binders are generally Portland Cement mixed with silicates or clay and sufficient water to allow the mixture to flow. This type is moisture absorbent to a large degree and waxes or such resins as courmarone-indine are added to lessen this objection.

After mixing, the material is molded under pressure at room temperatures and baked in ovens for about twenty-four hours. The finished products have considerable hardness, excellent heat resistance and desirable electrical and chemical properties but are somewhat brittle.

The cost of the materials and molds is considerably lower than for other classes of products, but they are difficult to store as they contain volatile solvents and oils. They are, therefore, usually prepared and molded in the same plant.

Cold molded types contribute to the war program in an indirect manner. Due to shortage of other plastic materials the cold molded products are being used to some extent as replacements in industry.

Forms available: finished products formed from cold molded compounds only.

Commercial applications: storage battery boxes, handles, knobs and connections for electrical equipment and cooking utensil handles and valve wheels.

Lignin

Lignin is a natural complex chemical substance of high molecular weight found in growing plants. It comprises about 30% of wood and cements the cellulose fibres together.

The possible use of wood waste and sawdust in producing a plastic molding composition had been studied for several years before the first lignin plastic appeared in 1937. This product was in a sheet form used for laminating. Two years later both thermosetting and thermoplastic compositions became available.

The chemical composition of lignin is questionable but investigations indicate that it is probably related to conferyl alcohol and caffeic acid.

Two methods of obtaining lignin plastic materials are under development. One uses wood chips as the starting point while the other originates with the waste sulphite liquor containing lignin obtained during the manufacture of paper. The wood chip method is carried out by placing wood chips in steam heated guns under 1200 pounds per square inch pressure for a few seconds. When this pressure is released, the chips are exploded by their high internal pressure. A fibrous mass coated with lignin is obtained. This procedure reactivates the lignin which after further treatment is available for rebonding the fibres to form laminated sheets.

Additional lignin may be used to increase

the bonding properties and the mass pressed into flat panels for industrial uses. These panels may be surfaced with colored synthetic resins or if color is not desired may be left with their natural glossy black finish.

The development of lignin from waste sulphite liquor is in its early stages but laminated sheets and molding compositions are now available and it is expected that special adhesive and coating resins will also be produced. Lignin resins in powder form are now used for extending phenolformaldehyde resins for use in varnishes, molding powders, and other applications. Up to 50% lignin resin may be used without greatly affecting the properties of the molded product. Commercial applications for lignin are continually being investigated and its low cost is a favorable factor particularly where large quantities of material are required.

The chief contribution of lignin to the war program is laminating sheets for partitions, walls, cases, etc., and as an extender for the important phenolic resins.

Forms in which available: sheet forms for laminating and molding compositions.

Commercial applications: laminations and paneling.

Phenolformaldehyde Resins

Phenolformaldehyde resins are one of the group of resinous condensation products formed by the reaction of different phenols and aldehydes.

Phenolformaldehyde was the first of the thermosetting plastic resins developed. The original patents were granted about 1910 and the first molding composition was introduced soon afterward. It is, perhaps, the most adaptable of synthetic resins and from the standpoint of volume the most important.

Phenolformaldehyde resin is prepared by the reaction between phenol and formaldehyde. This reaction takes place in the presence of catalytic agents under carefully regulated conditions. The resulting thermosetting type resin will soften under moderate heat and shortly harden into an infusible mass.

The various phenolic molding compounds of which there are hundreds, are made by allowing the resins partially to set. They are then pulverized and mixed with various fillers to obtain special physical or electrical properties. They are the cheapest of plastic materials with the exception of shellac and cold molded compositions which do not compare in strength.

Phenolformaldehyde resins were quickly accepted by industry due to their high strength, durability, moldability, dimensional stability and good electrical properties. Among the earliest applications were electrical insulation parts and laminated gears. The use of these resins has grown rapidly and new applications are constantly being developed.

Laminated products formed with phenolic resins are extremely strong and obtainable in surfaces imitating wood, marble, onyx, etc.

Phenolformaldehyde resins are the most widely used of all plastic materials in the war program. In the forms of molding compounds, particularly those containing rag and fibre fillers, laminated products, adhesives and protective coatings, they serve a wide range of important purposes in practically all branches of the service.

Molded phenolics are used for such varied applications as helmet liners, grips, and handles for pistols, bayonets and machine guns, fuses, distributor heads, instrument cases, housings, closures, insulation and similar articles. The laminated phenolic articles used are pulleys, gears, aircraft flooring, bulkheads, partitions, aircraft control tabs, seats, tables, and many others.

As adhesives, phenol formaldehyde resins are widely used in the many applications found for veneers and plywoods.

In addition to items mentioned above, a large number manufactured for industry during peace time are now used as war materiel.

Forms in which available: phenolic resins —granular or powder molding compounds made up in a large number of special types, liquid resins, varnishes and adhesives.

Phenol Laminated Forms — sheets, rods, tubes and fabricated parts.

Commercial applications for molding materials and resins: abrasive wheels, automotive and airplane parts, camera cases, closures, electrical insulation parts, housings, radio and telephone equipment and parts.

Commercial applications for laminated materials: bearings, electrical apparatus, gears, trays, table tops, wall and door coverings.

Phenol-furfural Resins

Phenol-furfural resin is a member of the phenol-aldehyde resin group in which furfural is the aldehyde used.

Various plastic materials of the phenol aldehyde type may be obtained by the use of different members of the phenol or aldehyde families. Cresols, and xylenol have long been used with formaldehyde and about 1920 furfural and phenol were combined to form phenol furfural resin.

Furfural is found in commercial supply in the coverings of cereal seeds such as oat and rice hulls, corncobs, peanuts, bagasse etc. Such materials are treated with an acid and steam passed thru the mixture. The furfural vapors are carried off in the steam vapor and later obtained by condensation.

Chemically, furfural is an aldehyde containing three double bonds and a carbonyl group. It is particularly reactive and its structure assists in the formation of long chain molecules which will polymerize to form curable products of high impact resistance and dimensional stability.

Phenol-furfural resin is thermosetting and flows readily thus permitting large parts to be molded. As these resins can be kept in a heated chamber for relatively long periods without losing their plasticity they can be molded by transfer and recently developed thermosetting injection methods.

This material will not scorch at high molding temperatures and cures rapidly thus enabling speedy molding production.

Forms in which available: pulverized and liquid resins, molding compounds, varnishes.

Commercial applications: mechanical and electrical parts, housings, closures, radio cabinets, etc.

Polystyrene

Polystyrene is a crystal clear, odorless, tasteless, thermoplastic material formed by the polymerization of styrene. It has been known for about a hundred years but it was expensive and difficult to obtain a product of sufficient durability and transparency to compete with other thermoplastic materials. In 1937 two styrene products were introduced which overcame these difficulties. Since then it has grown rapidly in industrial importance.

Styrene is prepared from ethylene and benzene through the intermediate production of ethyl benzene. It is then polymerized through the carefully controlled use of heat, light or catalytic agents, or combinations thereof and a hard tough transparent resin results. The rate of polymerization is highly important to the properties of the finished products which may be tough or brittle depending upon the extent of the action.

Among the characteristics of this material which have proven commercially valuable are its low power factor and dielectric constant at high frequencies, infinitesimal water absorption, transparency, dimensional stability and ability to transmit light around curved sections.

Polystyrene finds many applications in the war program. Its transparency, exceptional electrical properties and resistance to water and chemicals are utilized in aircraft panels, antenna mast bases, insulators and insulating films and similar applications. However, the most important use of styrene is in the pro-

duction of a synthetic rubber. Buna S rubber is a co-polymer of butadiene and styrene. The War Production Board has taken steps to insure first call on styrene for this purpose.

Forms in which available: molding powders.

Commercial applications: edge lighted instruments, radio, refrigerators and television parts, transparent automotive and aircraft parts and various trim.

Polyvinyl Ester Resins

Polyvinyl ester resins are the polymers of vinyl alcohol esters and the copolymers formed from mixtures of such esters.

The commercial development of this thermoplastic group began about twelve years ago but has already demonstrated wide industrial possibilities and increasing demand. The important members of this class are polyvinyl acetate, polyvinyl chloride and the mixed copolymers of both, known as copolymerized vinyl chloride-vinyl acetate. Each material has its own properties and the copolymer, inheriting the best characteristics of both, has become the most versatile and widely used.

Vinyl acetate and vinyl chloride are formed by passing acetylene thru acetic and hydrochloric acid respectively and their polymers are formed under heat in the presence of a catalyst. The products are dried, compounded with plasticizers in the case of polyvinyl chloride, and packed for industrial use.

The polyvinyl copolymer (polyvinyl chloride-acetate) is formed by mixing the individual monomers with a solvent and catalyst and allowing copolymerization to proceed to a desired degree. Different properties are obtainable by varying the percentages of chloride or acetate monomer in the mixture.

These materials are in general characterized by their adhesiveness, elasticity, toughness and resistance to chemicals. These qualities prove of value in such applications as coatings for fabrics.

Closely related to the vinyl ester resins are the family of polyvinyl acetals of which polyvinyl butyral is the most important.

This resin is formed by the hydrolysis of polyvinyl acetate to polyvinyl alcohol. Butyraldehyde is then added and condensation takes place yielding polyvinyl butyral which is precipitated. After washing and drying, it is further treated and flexible, transparent rubber like sheets are obtained.

This material is transparent, stable to light and tough over a wide range of temperatures. It also possesses exceptional adhesiveness and its use as an interlayer has made possible the production of improved safety glass.

In the preparation of all polyvinyl compounds, careful consideration is given to polymerization conditions. This action is susceptible to light, heat and pressure and various products of widely different properties and molecular weights will be obtained depending upon the degree of polymerization.

The polyvinl esters and copolymers are in demand for war applications. Large amounts are used as insulation on electrical wires and cables in all types of ships. Vinyl coated fabrics are water resistant and used for such purposes as raincoats, helmets, cockpit covers, etc. Other applications include storage battery separators, radio escutcheons, navigation instruments, and coated paper articles. The Polyvinyl butyral finds wide demand in laminated glass.

Forms in which available:

- *Polyvinyl halides:* molding and extrusion mixes and solutions.
- *Polyvinyl esters:* molding compounds and solutions.
- *Polyvinyl copolymers:* sheets, rods, tubes, molding compounds and films.
- *Polyvinyl butyral:* laminating sheets, molding compounds.

Commercial applications:

- *Polyvinyl halides:* electrical wiring insulation, flexible tubing, tank and container linings, molded articles.
- *Polyvinyl esters:* adhesives, inks, metal-

lic paints, molded articles, containers and leather finishes.

Polyvinyl copolymers: cement, metal coatings, films, radio parts, cockpit covers, records, storage battery separators.

Polyvinyl butyral: laminated glass.

SHELLAC

Shellac is a natural product secreted by insects indigenous to Asia and has been used in polishes and varnishes for centuries.

Its possibilities as a plastic molding material were discovered about 1863, and it became the second plastic to be used in the United States. In 1895 a satisfactory flat disk phonograph record was developed using a shellac molding compound. This application, the first to use large amounts of shellac, continues to be its largest single outlet.

Chemically, shellac is a solid solution of several similar chemical compounds of high molecular weight. They appear to be composed of monobasic-interester acids of which aleuritic, shelloic and kerrolic acids and their isomers have been identified.

Shellac has excellent binding and electrical qualities and has long been used for electrical insulating materials. It is particularly employed in the manufacture of high voltage insulators. Considerable quantities of shellac are used as a binder for insulating materials made of fibres, paper or mica.

Its high scratch hardness and its workability at steam table temperatures are valuable industrial properties.

Practically 100% of available supplies of shellac are now reserved for war materiel. Its chief direct uses are for protective coatings and electrical insulators but many indirect applications are also important.

Forms in which available: discs, flakes, solutions and varnishes.

Commercial applications: adhesives, electrical and thermal insulation, phonograph records and protective coatings.

UREA RESINS

Urea formaldehyde is a water clear, tasteless odorless resin formed when urea reacts with formaldehyde. The fact that a plastic substance was obtained when this reaction took place was known before 1900 but little progress was made in its development.

Considerable research was undertaken around 1925 both here and abroad and two urea formaldehyde resins were commercially introduced in 1929. These resins, which are thermosetting fill a field all their own in rapidly increasing volume.

Urea resins are formed by the reaction between urea and an aqueous solution of formaldehyde (formalin) under varying conditions of temperature, time, acidity, or alkalinity. Fine alpha cellulose is added to overcome a tendency to crack and a composition which can be readily molded is obtained. Different degrees of plasticity and viscosity may be obtained by varying the amount of condensation.

Considerable use is made of urea resins as adhesive bonding agents in laminated and plywood products, particularly on surface laminae where color effects and a hard durable surface are desired. The paper industry uses a considerable volume of urea resins both as a protective coating and in such articles as paper towels where wet strength is desired.

The use of urea resins in the war effort is shown by their use as adhesives for either the heat-setting or cold-setting types of plywood construction. Other uses are in light fixtures, tableware for planes, housings and minor articles requiring lightness in weight.

Forms in which available: Molding granules and powders. Heat setting adhesive solutions. Resin solutions for laminating or treatment of fibres. Cold setting cements.

Commercial applications: Adhesives, baking enamels, buttons, closures, colored laminated sections, housings, lighting reflectors, tableware and toys.

Melamine

A new resin compound, melamine formaldehyde, was introduced about 1939. To some extent, its properties and methods of processing are similar to urea formaldehyde resins and it finds the same general applications.

Chemically, melamine is a trimer of cyanamide and is produced from calcium cyanamide through the intermediate production of dicyandiamide.

When melamine formaldehyde is used as a molding compound or for surface treatments the end product is harder and more resistant to heat, scratches and weak acids of alkalies than those obtained when using urea formaldehyde. Its heat resisting properties particularly open a field of new applications.

Melamine molded products have high impact strength, non tracking electrical properties and resistance to heat and weather.

Melamine laminated base products and adhesives are also available.

Melamine products find various applications in the war program. The resins are used in many plywood parts. Melamine laminated materials are used in dial panels and similar applications. Aircraft ignition parts are molded of melamine due to its special electrical properties.

Forms in which available: adhesives, molding powders, and resins in solution for laminating.

Commercial applications: heat resisting parts, lighting accessories, lamination, table ware and trim.

Vinylidene Chloride Resins

Vinylidene chloride is a tough thermoplastic material obtained by a reaction between chlorine and ethylene. These resins were first introduced in 1940 and rapid advances have been made in their production and molding techniques.

Chemically, vinylidene chloride differs from the older vinyl chloride in having two chlorine atoms per monomer instead of one. Ethylene, from petroleum, and chlorine, from brine, may be combined to form monomeric vinylidene chloride. By regulating the amount of polymerization and copolymerization, resins having a wide range of properties may be obtained.

These materials are tenacious and durable with splendid chemical, heat solvent and water resistance qualities together with a ready colorability. Such properties have opened, for vinylidene chloride, industrial applications that were formerly impossible for plastic materials. Rapidly developing uses of vinylidene chloride are in woven or braided fabrics and extruded tubing for various purposes.

Vinylidene chloride in the form of extruded tubing is becoming more important in the war program. Its use as a substitute for copper and metal piping and tubes has found various direct and indirect war applications.

Forms in which available: extruded tubing, rods, filaments and strands for weaving.

Commercial applications: abrasive wheels, chemical tubing or pipes, fish lines, narrow fabrics and tapes, wire and hose coatings and woven furniture webbings.

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Platinum

The chemical and electrical uses of platinum have grown rapidly and it is listed as a "critical" material in the war effort. In many of its uses, it is without satisfactory substitutes. A precious metal characterized by a high melting point (3190°F.), it is whitish-gray in color and resistant to oxidation at high temperatures. Allied metals are palladium, iridium, rhodium, ruthenium and osmium. Platinum is more ductile than silver, copper or gold, and heavier than gold. While it can be dissolved in hot aqua regia, it resists attack of alkalies and most acids.

The annealed metal has a hardness of 37 Brinell and tensile strength of 42,000 pounds per square inch, and, when hard-rolled, the Brinell is 90 and the tensile strength 54,000 pounds.

About one-half of the United States consumption in normal times goes into jewelry; one-fifth into chemical apparatus; one-tenth each in electrical and dental uses; and the remaining tenth in miscellaneous uses. In the chemical industry platinum is used as a catalyst to produce sulphuric acid and for ammonia oxidation to produce nitric acid and nitric oxides. Other uses are in lining processes and reaction vessels, in the hydrogenation of organic compounds, and in rayon spinnerets, nozzles for the production of fiber glass, glass insulators for the bases of electric light bulbs, tubings, valves, syphons, and safety disks for handling corrosive liquids and gases, anodes for the production of "per" salts, gas-analysis cells, crucibles, and laboratory equipment. In the electrical industry, it is used for thermocouples, temperature measuring and recording instruments, precision resistance thermometers, high-temperature furnace windings, spark-plug electrodes, magneto contacts, electrical contacts, relays, thermostats, automobile voltage regulators and direction indicators, and switches for potentiometric recorders.

Platinum is obtained as a by-product in the mining of copper, nickel and gold. In the nickel-copper ores of the Sudbury district of Canada there is about an ounce of platinum in every 20 tons of ore. Much of the metal is obtained from placer deposits, as in Alaska and Colombia. These are alluvial sands and gravels where the natural movement of the beds has resulted in the concentration of heavy particles near the bottom of the beds. In commerce the metal is generally sold in the form of sheet and wire. Much of it contains from 5 to 10 percent iridium as a hardener. Ingot platinum is an unusual form as the metal does not pour easily. In porous form it is known as sponge platinum.

Outstanding world producers of platinum ores and concentrates are Canada and the Soviet Union, followed in importance by Colombia, the Union of South Africa and the United States. World production is estimated at about 400,000 ounces (platinum content) annually—Canada and the Soviet Union producing about 35% each, the United States and South Africa about 10% each and the balance (about 35,000 ounces) coming from Colombia. During the last two decades the output has more than tripled, Canada's production expanding from 13,000 ounces in 1929 to 161,000 ounces in 1938, while that of the United States, chiefly from Alaska, jumped from 6,000 ounces in 1929 to 46,000 ounces in 1938. The major part of the world's output of platinum ores and concentrates was normally refined in the United Kingdom and the Soviet Union, the remainder in Germany, France, Norway and the United States. Canada's metal normally went to the U. K. and Norway for refining while Germany, in the past, refined part of the Russian output. The war, of course, has disrupted this refining process. International trade in platinum consists in the movement of crude materials to refining countries, the export of partly refined and refined platinum, and, lastly, trade in manufactures of platinum. Since the outbreak of the war the entire Colombian production has gone to the United States. In 1940, the United States imported 127,000 ounces, chiefly in the form of crude platinum and shapes. During 1935-1940, the United Kingdom supplied about 65 percent of the imports; Colombia about 18 percent; the Soviet Union about 11 percent.

The United States consumes about one-half of the estimated 400,000 ounces of primary platinum produced annually in the world, and is dependent on foreign sources for most of its requirements. Imports, con-

sisting of both crude and refined platinum, are free of duty.

Platinum is sold by the troy ounce. A cubic inch of the metal weighs 11.28 troy ounces. The present price is $35-$36 per troy ounce.

Supplies of platinum have been well maintained since the outbreak of hostilities. There have been increased imports from the United Kingdom and Colombia, and greater quantities of Alaskan and Canadian platinum are being refined in the United States. Production in Colombia is being encouraged.

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Plumbago

See Graphite

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Polystyrene

See Plastics

★ ★ ★

Polyvinyl Acetate

See Polyvinyl Ester Resins

★ ★ ★

Polyvinyl Chloride

See Polyvinyl Ester Resins

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Polyvinyl Ester Resins

See Plastics

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Pond Pine

See Southern Pine

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Ponderosa Pine

A WESTERN yellow pine, Ponderosa pine is exceeded only by Southern pine and Douglas fir in the annual cut in the United States. It is a durable softwood. Trees are large, growing to a height of 175 feet and often to a diameter of 5 to 7 feet.

In 1940, production of Ponderosa pine totaled 3,612,945 thousand board feet out of a total U. S. cut of 28,934,127 thousand feet of all lumber. Oregon accounted for 1,597,739 thousand board feet; California 955,420 and Washington 379,388. Idaho, Montana, Arizona and New Mexico supplied the bulk of the balance.

Like Southern pine, Ponderosa pine is a source of turpentine and rosin.

The War Production Board Order L-121 which became effective on May 13, 1942 limits the sale, shipment or delivery of Ponderosa pine for construction purposes. Defined in the limitations are: (1) "'Construction lumber' means sawed lumber whether rough, dressed on one or more sides or edges, dressed and matched, ship-lapped, or grooved for splines," etc. covering various specifications.

Maximum prices for "Western pine lumber" made effective by OPA—through Price Schedule No. 94, dated Feb. 3, 1942,—brought under a price ceiling the largest remaining section of the softwood lumber industry not previously regulated. It covers Ponderosa pine, Idaho White pine, and Sugar pine, which species account for approximately 21 percent of the total lumber production in the United States.

Ponderosa, Idaho White, and Sugar pine lumber are used in the manufacture of millwork and boxes, and for interior and exterior construction purposes, with a considerable degree of interchangeability. The lower grades of Ponderosa and Sugar pine are particularly well-adapted to the box market. In addition to the civilian demand for these woods, both for building construction and for container purposes, particularly containers for agricultural products and canned goods, government buying for use in cantonment construction purposes, as well as for boxes for armament and other purposes has become an increasingly important factor.

Production of Sugar pine in 1940 totaled

363,041 thousand board feet, about 10 percent of the Ponderosa variety, of which 293,526 thousand board feet were cut in California and 69,515 thousand in Oregon—the only two States reporting this variety.

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Pork

THE pig is a very versatile character, living in various climates, eating many types of food, growing quickly, adapting himself to many levels of civilization, and multiplying more rapidly than any other domestic animal except the rabbit.

Pork was held in great esteem among the ancient Greeks and Romans, and in olden Crete the pig is said to have been held sacred. Aristotle reported seeing a race of hogs with undivided hoofs; and Homer in the "Odyssey" tells how Penelope's suitors feasted on pork, and relates that Ulysses upon his return first sought the dwelling of his faithful servant, Eumaeus, "the divine swineherd." Some authorities even claim that the ancient Israelites kept herds of hogs and that Moses' ban on pork would have been unneeded "had not pork then been the prevailing food of that nation."

Caesar recorded that the ancient Britons lived largely on a great variety of pork dishes.

In Frankfort-on-the-Main, in 1481, a law was passed forbidding homeowners to have a pig-pen between the house and the street; and residents of Ulm were forbidden to keep more than twenty-four swine per family. In France about the same date a hog was tried in court for the murder of a baby, and was convicted and hanged. Among Leonardo da Vinci's many inventions was a spit for roasting pigs, and it is said that while painting the "Last Supper" he left the head of one of the Apostles unfinished for a time in order to improve the blades of a new machine for mincing meat and making sausage.

Cervantes described the lady-love of Don Quixote as "the best hand at salting pork of any woman in all La Mancha."

In the New World hogs rode the waves with Columbus, Ponce de Leon, and De Soto, and with the Portuguese, the French, and finally the English. De Soto, landing in Florida with thirteen hogs at the start of his march of a thousand miles through southern forests, prairies, mountains, rivers, and swamps, saw parts of his herd devoured by hungry soldiers, or stolen by Indians and probably by other creatures of the forest, or cremated by the dozen in the battle pyre of an Indian village ambush; yet after three despairing years of this he died in Arkansas leaving a herd of 700 to be divided among his men!

In early Virginia the theft of a hog could be atoned for only by the payment of a thousand pounds of tobacco to the owner, and an equal amount to the informer; and the thief who failed to make appropriate restitution in smokes had to work a year for each of these gentlemen. A bit later, however, plantation owners turned their pigs loose in the woods in order that their pork might grow wild and be hunted like any other wild game.

LaSalle brought to the Texas coast eight pigs which swam in the moat of his fort, and thrived on buffalo meat scraps and on the rattlesnakes shot for them.

New England towns sometimes created the office of hog reeve, or public swineherd. Thus Salem in 1638 provided that the reeve should blow his horn at 6 A.M., by which hour all owners of pigs should have them ready to be collected and taken out to graze. At first the office was greatly respected and much sought, but it offered so much opportunity for poking fun that its dignity eventually was lost. Thus the town of Concord is said once to have chosen as its public pig man the philosopher Emerson!

Up and down the country's frontiers the

pig scampered into the woods and made his own living from its nuts, roots, snails, snakes, and insect larvae. Both his digging and his destruction of insect pests were believed helpful to the forest. In the process he had to fight off the bears and the wolves, and became as wild as they. Often when the pioneers of the Cumberlands and Smokies came home hungry for supper, they were fed the great "stew pie" of that region, in which were mixed three types of game brought in by these hunters—venison, bear, and pork; and for window panes these settlers used paper greased with hog or bear fat.

Now and then the hog dug his nose into local politics. In Boston a housewife missed her pig and claimed her wealthy neighbor had eaten it. Church and jury in turn denied her claim, and the defendant even won damages against her for defamation of his character, but she appealed to the legislature, which argued for a year and finally split permanently into two houses—one including the conservatives who had sided with the wealthy captain, and the other the democrats who knew how much it hurts to lose one's pork supply.

Texas, during its nine years as a republic between its winning of independence from Mexico at the battle of San Jacinto and its annexation to the United States, is said to have lost a loan of 37,000,000 francs because of a dispute over the pigs of an Austin tavern keeper, which invaded the stables of the French ambassador's horses. The ambassador's servant killed the pigs; the tavern keeper whipped the servant; the ambassador, not getting sufficient redress for this "scandalous violation of the laws of nations," called for his passports; and for three years diplomatic relations between two nations were suspended.

Charles Dickens, after his visit to New York in 1842, included in his description of Broadway with its top hats and hoop skirts (in his "American Notes") four paragraphs on a rambling Broadway hog, one of many then seen on the street. He found Mr. Pig "going wherever he pleases, and mingling with the best society, on an equal if not a superior footing, for everyone makes way when he appears, and the haughtiest give him the wall."

Pigs and pork were largely responsible for the beginning of the American meat packing industry and even for the word "packing" in its name. In the days before artificial refrigeration in any form was available, one of the best ways of keeping meat for future use was to pack it in salt. Thus the farmers of the colonial frontier packed not only pork and beef (especially pork) but also venison and even bear meat. And in the years following 1641, while England was busy with the wars of Cromwell's day, some of these farmers decided to make a business of meat packing, and were able to take over the former British trade in salt meats with the West Indies.

The names of these first American meat packers are not now known. The earliest one now identified was of the next generation — Captain John Pynchon, a farmer, storekeeper, fur trader, miller, judge, and leading citizen of Springfield, Mass., and son of William Pynchon, founder of that city. He was sending cattle to Boston by 1655, and between 1662 and 1683 bought and barreled large numbers of hogs, as well as buying much of the pork that his neighbors also had packed. Pork was apparently sent to Boston by wagon from the Connecticut River valley as early as 1667, the wagon taking pork and potash and bringing back barrels of rum. Grain and pork, incidentally, were sometimes used as money in early Massachusetts, at prices fixed by the colonial government; and to be destitute of salt pork was even considered "disreputable."

In Boston half a century later, the arrival of autumn with its storing of the winter sup-

ply of salt pork brought mingled thanksgiving and chagrin to a boy named Benjamin Franklin, who often became restless during the long graces which accompanied Massachusetts meals. So one day after the pork had been dutifully stored away, he suggested that if his father would only "say grace over the whole cask, once for all, it would be a vast saving of time."

George Washington left to his heirs a wandering, uncounted stock of razorback hogs. However, he had learned to give his fattening pigs a floor, a roof, and running water.

Meat packing as a commercial enterprise received additional impetus in 1794 from an unexpected source—the collapse of the Whiskey Rebellion in western Pennsylvania. This tempted corn farmers to try marketing their best cash crop in hogs instead of hogsheads! In the same year "Mad Anthony" Wayne's victory over the Indians at Fallen Timbers (southwest of modern Toledo) opened most of the Ohio valley to safer settlement and farming, including hog farming. In the next half century, therefore, Pittsburgh, Buffalo, Cincinnati, St. Louis and several adjacent river towns, and finally Chicago and Milwaukee became important packing centers; and Cincinnati after 1830 was nicknamed "Porkopolis," having "perfected the system which packs fifteen bushels of corn into a pig and packs that pig into a barrel and sends him over the mountains and over the ocean to feed mankind." But in the same period hogs as well as cattle were driven over the towering Alleghenies—the hogs sometimes in herds of 5000—to feed residents of the Atlantic seaboard who preferred their meat fresh, even though it had to come from mountain-climbing razorbacks.

In the Ohio and Mississippi river towns meat packing was a hurried winter industry only, and the meat packer was usually a warehouse man who packed the farmer's hogs on commission, and tried to ship them for him before the rivers froze over, or before warm weather returned. Often the packer in turn had them dressed in some other building, himself paying a commission for the service, which was performed without machinery.

Abraham Lincoln, as a boy on the Indiana frontier in these days, lived chiefly or at times even exclusively on meat—the game of the forest. When at length his family was able to have pigs and chickens and a garden they "felt as if they was gettin' along in the world," as his cousin, Dennis Hanks, expressed it. Young Abe's one brief winter of schooling was in a log schoolhouse with a teacher who apparently took his pay in skins and hams and other farm produce, perhaps including live hogs; and at the age of sixteen the boy made $6 a month as a farmer and ferry-man, and 31¢ per day extra at hog-killing time.

In some parts of England, about 1800 and earlier, the pork producer would haul his hams and bacon around the countryside, hanging them for drying in farmers' chimneys and roofs. Since the meat sometimes dripped brine on housewives' caps, or even fell and broke a spinning wheel or scared the baby, he had to carry also peace-offerings of ribbon or tobacco.

Meats in the home, declared another English writer in 1823, "are great softeners of the temper and promoters of domestick harmony." Said he, "A couple of flitches of bacon are worth fifty thousand sermons and religious tracts. The sight of them upon the rack tends more to keep a man from poaching and stealing than whole volumes of penal statutes, though assisted by the terrors of the hulks and the gibbet."

Today the name "packing" in the meat industry has largely been outgrown. The barreled salt pork with which "Porkopolis" and other river towns "fed mankind" is now packed only for a few lumber camps and a limited export demand.

The annual number of hogs dressed by

American packers, retailers, or farmers runs around 70,000,000, or somewhat larger than the total hog population as of January 1. Government estimates of increased pig and pork production in 1942 (based on record spring and fall pig crops, estimated as totaling 105,000,000) indicated that the number dressed in 1942 might be nearer 80,000,000 or even 90,000,000. Thus millions of pigs never "make" the January 1 census estimate, as they arrive after one such date and are turned into pork before the next one. This group of course comprises a large part of the usual spring pig crop of about 50,000,000 annually; the fall crop of around 30,000,000 arrives in time to see Santa Claus and to get included in the census almost inevitably. Because of these waves in pig production, meat packing is still a somewhat seasonal industry, but far less so than before refrigeration; today only about half of the commercially dressed pork is processed in the five months from October through February, and the lowest or hottest month in summer handles more than half as much as the coldest or busiest month in winter.

In 1941 pork consumption per capita in the U. S. was about 69 pounds. It had ranged from a high of 77 pounds in 1908 to a low of 48 pounds in 1935, and had averaged about 67 pounds in the four decades since 1900.

The hog has been called "the poor man's friend," because in many countries and in many ages it has been found that practically any family, no matter how poor, can grow a pig. Sometimes he is called "the mortgage lifter"; and in Ireland it is sometimes charged that "the gentleman what pays the rent" is better treated than the peasant's own children. But despite his general versatility, the hog is not adapted for grazing like the sheep or steer upon the endless and often semi-arid grasslands of many continents; nor is he set apart, like the dairy cow, or India's sacred cattle, in many of the world's most populous nations; and the fact that he is more quickly grown and fattened and then rather promptly turned into hams and pork chops usually tends to eliminate the possibility of his surviving long enough to be included in more than one census, if any. At any rate, no matter what the exact totals of world pork consumption might show if available, a glimpse of such estimated live stock populations as are obtainable from various countries from time to time shows the hog apparently sadly outnumbered in the world as a whole; in the 1930's a world that had room for apparently about 700,000,000 each of cattle and sheep seemingly wanted only about 300,000,000 hogs.

Of the hogs, about a third were in North and South America; probably another third in Asia; and possibly almost a third in Europe. There were almost five times as many hogs in the United States as in the rest of North America; and Brazil, with about 24,000,000, had almost four-fifths of South America's apparent total. Germany and Russia had about 30,000,000 each; Poland and France about 7,000,000 each; Spain and Hungary and the United Kingdom about 5,000,000 each. Japan with only about 1,000,000 was overrunning China with about 80,000,000. There were apparently only about 3,000,0000 hogs in all of Africa, and only about half that many in Australia, where lambs seem to outnumber pigs by a ratio of eighty to one.

Denmark, the Netherlands, Poland, Czechoslovakia, and Hungary were exporters of pork. The United States, Canada, and Ireland still are, and of course the war has greatly increased the need of such shipments, to England especially. The scarcity of shipping space has prompted the successful use of frozen lard as a refrigerating agent for trans-Atlantic shipments of meat.

Imports of live stock and meat into the United States are usually negligible or almost so.

In 1940 our exports of these items in-

cluded about 9% of the lard produced, about 1% of the pork, and less than 1/1000th of the beef.

Until the rubber shortage intervened the trend of live stock delivery to market was to hauling by truck. Of the live stock received in 1941 at the sixty-eight public markets listed by the United States Department of Agriculture, for example, approximately 69% of the cattle, 67½% of the calves, 70½% of the hogs, and 34% of the lambs arrived by truck.

The dressed pork is delivered to the retailer (or through him to the housewife) in various containers, depending on the nature of the product, the size of the order, and the delivery situation. Containers range from small cartons to barrels and wirebound boxes. Hams and bacon are ordinarily wrapped in three layers of paper, one grease-resistant, one absorbent, and one of parchment with the label, but since the Government requested conservation of paper, fewer layers are being used.

Pork may be regarded as somewhat less perishable than beef or lamb in the sense that more than half the pork carcass is or at least may be cured as ham, bacon, picnics, dry sausage, etc. Its special nutritional values include its exceptional richness in vitamin B_1, now called thiamine—even after the thorough cooking required, pork is one of the richest sources of this vitamin—and the high total of calories which bacon and other pork products rich in fat offer the physical worker or athlete who wants a meal that "sticks to the ribs."

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Portland Cement

PORTLAND CEMENT, the basic raw material of concrete, is made by burning powdered limestone to a high temperature with clay, shale or blast furnace slag and grinding the resulting clinker to the fineness of flour. A small amount of gypsum is added to the finished product to slow down the rate of hardening. The manufacture of portland cement is a highly complicated process which involves some 80 different operations and requires heavy and expensive machinery. Rigid laboratory control is necessary to insure a uniform product. All of the raw materials must be ground to a very fine powder before being burned and the resulting clinker, as the product which comes out of the kilns is called, must be again ground fine enough to pass through a sieve with 40,000 openings to the square inch.

Large deposits of limestone and the accessibility of other raw materials used in making portland cement govern the location of cement mills. According to the U. S. Bureau of Mines, 152 cement mills were in operation in 1940 in 35 states. Pennsylvania has the greatest number of cement mills of any state and manufactures a far larger quantity of cement than is made in any other state. Other states in which cement is made are:

Alabama	Missouri
Arkansas	Montana
California	Nebraska
Colorado	New Jersey
Florida	New York
Georgia	Ohio
Idaho	Oklahoma
Illinois	Oregon
Indiana	South Dakota
Iowa	Tennessee
Kansas	Texas
Kentucky	Utah
Louisiana	Virginia
Maine	Washington
Maryland	West Virginia
Michigan	Wisconsin
Minnesota	Wyoming

The Bureau of Mines Minerals Yearbook for 1941 reports that an average of about 648 lb. of raw materials, exclusive of fuels and explosives, is required to produce one

barrel of finished cement weighing 376 lb. 1940 is the last year for which the Bureau of Mines gives data on raw materials, but it reports that the cement industry in that year used the following total quantities of raw material:

33,986,000 tons of limestone and cement rock.

4,021,000 tons of clay and shale.

581,000 tons of blast furnace slag.

932,000 tons of marl.

121,000 tons of iron ore.

806,000 tons of gypsum.

1,753,000 tons of other materials, such as oyster shells, sandstone, sand, cinders, fluorspar, diatomite, diatomaceous shale, pumicite, Fuller's earth, bentonite, silica, quartz, ashes, pyrite ore, pyrite cinder, roll scale, calcium chloride, and hydrated lime.

The Bureau of Mines also reports that in 1940, when the cement mills in the United States and one in Puerto Rico made 130,-216,511 barrels of cement, the industry used the following quantities of fuel:

5,633,156 short tons of coal.

2,424,976 barrels of oil.

41,948,699,007 cubic feet of natural gas. The cement industry is also a large user of electric current, an average size cement mill requiring about the same amount of electricity as would furnish light and power for a city of 50,000 population.

Although it has been many years since any American-made cement was shipped in barrels, the Bureau of Mines uses barrels as a unit of measure. Cement is commonly shipped in either cloth or paper sacks holding 94 lb., or sometimes it is shipped in bulk. Four sacks are equivalent to one barrel and a 94-lb. sack is a convenient unit because it contains exactly one cubic foot of cement. According to the Bureau of Mines, 80.9% of the cement shipped from mills in 1940 was moved by railroad; 15.6% by truck; and 2.2% by boat. Method of shipping the remaining 1.3% was not stated. 25.6% of the shipments of portland cement in 1940, the Bureau says, was in bulk; 42.5% in paper bags; and 31.9% in cloth bags.

The packing operation is largely automatic. The empty sacks if of cloth are first tied, or if of paper are glued and then hung upside down with the discharge nozzle of the packing machine inserted through a small opening in the bottom of the sack. The cement flows like water through a 1-inch nozzle, being shut off automatically when exactly 94 lb. of cement have entered the sack. Then the weight of the cement on a small flap inside the sack closes the opening as the sack is turned right side up. When cement is shipped in bulk it is pumped into box cars similar to those used for carrying grain. Portland cement is made to meet standard specifications of the American Society for Testing Materials and requirements of the United States government.

However, in addition to the normal gray portland cement, the Bureau of Mines lists white portland cement which it describes as a standard portland cement, the raw materials of which are unusually pure, with an especially low iron content. This is made by a few cement mills and is used in work where a white effect is desired or for portland cement paint in white or light tones.

The manufacture of portland cement is somewhat seasonal, especially in the northern states, because the peak demand for cement comes during the open building season. Cement mills commonly work during the slack season to accumulate large stocks of finished cement and unground cement clinker against the time when the demand will be heavy.

Cement manufacturers maintain well-equipped laboratories for both the physical testing of the cements and chemical control in the manufacturing process in order to insure a standard quality which will meet the most exacting specifications. Raw materials

are first tested while they are still in the ground. Throughout the manufacturing process, samples are taken hourly to insure accurate blending of all the ingredients. Before burning, the raw mixture is checked and the finished cement also must meet numerous physical and chemical requirements before delivery. Before the finished cement is packed or goes into bulk storage, samples are taken hourly from each finishing mill and the composite product of the entire battery of finishing mills is tested every 60 minutes. This scientific control results in a product so standardized that samples taken at random from any part of a storage silo will have the same characteristics.

Portland cement being the most important ingredient of concrete has literally thousands of uses. In 1939, the last year in which statistics are available on the distribution of portland cement, the use was divided as follows:

Paving: roads, streets and airports..	20%
Structural: buildings, bridges, and railway uses	30%
Conservation: water supply, sewerage and reclamation	18%
Housing: one and two-family houses and small uses	22%
Miscellaneous uses on the farm......	10%
	100%

The Bureau of Mines reports that American cement mills produced 164,002,000 barrels of portland cement in 1941, an increase of 26% over 1940 and the highest production recorded since 1929. This, the Bureau says, was still only 65.4% of the existing capacity of cement mills in the United States.

Cement manufacturers sell their product either direct to consumers or to dealers with prices quoted per barrel, which is equivalent to four (94-lb.) bags. The basis is F.O.B. cars or barges, delivered to rail heads or piers. The dealer has a definite place in the market sequence because of his ability to buy in large quantities and store until needed by the ultimate buyer.

Although selling of portland cement is a highly competitive business the range of operations for the individual companies is limited to a certain extent by distance inasmuch as freight charges account for a large part of the delivered price. Thus, mills are in a better competitive position when selling close to the plant. New York City dealers in August 1942 were selling at $2.44 per bbl., paper bags, in truckload lots, delivered from dealers' warehouse to job sites.

The quality of cement is constantly safeguarded by rigid classifications set by the Specifications Committee of the American Society for Testing Materials. This committee includes representatives of the federal government, the manufacturers, consumers and of the Bureau of Standards.

Cement manufacturers support the work of the Portland Cement Association, a cooperative research organization serving both the cement industry and all users of concrete. Its functions include scientific research on cement and its uses, the preparation and distribution of literature on concrete, and the promotion of new applications of concrete. The Association does not manufacture or sell cement and has nothing to do with the marketing policies of the cement companies.

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Potash

THE term potash in the chemical trades usually refers to the chloride and sulfate salts of potassium, but may also include the caustics, chlorates, and other compounds. Potassium chloride, known in the trade as muriate of potash, is a white salt, similar in appearance to ordinary table salt, but rather bitter to the taste. Some of the muriate on the market is pink or red in color, even when very pure, due to traces of iron

left in the salt by certain refining processes. The raw mined salts, which mostly are in the chloride form, may be red or nearly white. Under the term of manure salts, they may come on the market without any treatment to remove the impurities, which consist mainly of sodium chloride, with smaller amounts of calcium and magnesium chlorides and sulfates. Some native langbeinite is mined and sold after washing to remove sodium chloride. This mineral is a double sulfate of potassium and magnesium, and is sold on the market as sulphate of potash-magnesia. It is a grayish salt.

There are two principal sources of potash salts in this country. The most important source, quantitatively, is a salt deposit in the Permian Basin. Three mines are located in the vicinity of Carlsbad, New Mexico. The potash salts are about one thousand feet underground, and are mined much like ordinary salt. Another important source is the brine of a partially dried up lake at Trona, California. The brine is pumped out of the lake and by evaporation processes, the potassium chloride and other chemical components are separated in very pure form. Other less important sources are the brines of the Salduro Marshes in Utah, and the by-products of industrial alcohol production.

Production in the United States approximated one million tons of potash salts in 1941, equivalent to more than 500,000 tons K_2O. About 15,000 tons K_2O were imported during the year 1941, with current figures probably much lower. Prior to the outbreak of war in Europe, about half of the consumption in this country was of the imported product. World production figures are not available, but an estimate of two and one-half million tons of K_2O might be made.

About 90 per cent of the total potash production is used in fertilizers, with the other 10 per cent used in various chemical lines. The chemical uses are varied and include the preparation of caustics, which in turn are used in soft soaps and certain types of glass, and the preparation of chlorate and perchlorates used in match making, pyrotechnics, and related lines.

The marketing unit of potash salts is the unit K_2O, a unit being one per cent of a ton, or twenty pounds, except for chemical grades and sulphate of potash-magnesia which are sold by the ton.

The principal type of potash salt now used is the high-grade muriate form, priced at 53.5 cents a unit for the grade analyzing 60 per cent or more K_2O (Aug. 7, 1942). On the 50 per cent K_2O grade, the price was 56 cents a unit. Sulphate of potash was quoted at 75.5 cents a unit, and sulphate of potash-magnesia at $26.00 a ton, all ex-vessel ports. Manure salts are sold only f.o.b. mines at Carlsbad, New Mexico, at 20 cents a unit for the grade analyzing 22 per cent K_2O, and 21 cents a unit for those running 25 per cent minimum.

All prices are subject to a 12 per cent discount on orders placed before June 30 and when delivery of the entire order contracted for is accepted by the buyer. Nearly all the potash sold comes under the terms of this seasonal discount. Prices are the same as a year ago. Ceilings on potash fertilizer prices to consumers went into effect February 27, 1942, on a temporary basis and were made permanent April 28, 1942.

Potash salts are normally moved by rail and vessel, mostly in bulk, some in bags. Under present conditions, practically all the potash is moving by rail in minimum carloads of 40 tons of salt. The product is not perishable, the principal hazard being water, which will dissolve the product. If kept dry, the material may be stored indefinitely.

There are no duties or excise taxes on potash salts.

Some potash salts are used in explosives and other ordnance, in special optical glasses, and chemical manufacturing, but the chief use is as a fertilizer in crop production. The

war has almost entirely cut off foreign sources of potash, but the domestic industry has expanded sufficiently to meet requirements even with greatly expanded consumption by both agriculture and industry. This is in marked contrast to conditions prevailing during the last war when cessation of imports found the country without domestic sources, resulting in a tenfold increase in prices and an acute shortage in supply.

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Potash Alum

See Alums

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Potash Salts

See Potash

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Potash Spar

See Feldspar

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Potassium Alum

See Alums

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Potassium Bichromate

See Bichromates

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Potassium Chloride

See Potash

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Potassium Iodide

POTASSIUM IODIDE occurs as white crystals, granules or powder. It is extremely soluble in cold water and more so in hot water. The manufacture of potassium iodide consists of treating a hot solution of potassium hydroxide with iodine, evaporating the mixture to dryness, adding carbon and heating to redness to convert any iodate formed to iodide. The potassium iodide is then purified by recrystalization.

Potassium iodide is the most important iodide produced in the United States. In 1939, 914,926 pounds were manufactured, in nine plants, with a value of $1,074,653. Production in 1937 amounted to 612,696 pounds, valued at $599,027. Eight plants were in production in the latter year. Potassium iodide is packed in 250 and 350-pound barrels; 100-pound kegs; 25 and 100-pound cases; and 25-pound bags; and one and 5-pound bottles.

The two largest uses of potassium iodide are in medicine and in the manufacture of photographic emulsions. The United States Pharmacopeia requires that the official product contain at least 99 per cent of potassium iodide on a dry basis. The price of potassium iodide on June 1, 1942 was $1.35 per pound, a quotation that had been in effect for several months. On January 1, 1941 the price of potassium iodide was $1.20 per pound.

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Potatoes

IN THE United States potatoes are grown in every state and contribute generously not only to the farmer's food supply, but in most states to his cash income. The total acreage devoted to potatoes in the United States remains fairly constant from year to year at about 3 to 3½ million acres. Production, however, tends to fluctuate rather widely, dependent upon weather. Within the past eleven years, production has been as high as 427 million bushels and as low as 332 million bushels. Average U. S. yields ranged from 100.3 bushels per acre in 1933 to 123.8 bushels in 1937. Potatoes grow best where temperatures are even and moderate, rainfall 25 to 40 inches and soil both fertile and loamy.

The great bulk of the crop falls in the

"late potato" category. The two largest producing states are Maine and Idaho.

Following are important "surplus-producing regions" for "late" potatoes, harvested mostly in September and October. Idaho, Western Minnesota, central Wisconsin and Michigan supply Chicago, Milwaukee and the Twin Cities. The eastern counties of Virginia and Maryland find a ready market for their product in Washington, Baltimore, Philadelphia and New York during June and July.

Southern New Jersey, Eastern Long Island, Western New York and Aroostook County, Maine, have become well known for their excellent potatoes. These areas supply large industrial centers, especially New York City, with potatoes in the fall and winter. Other important late producing" states are Pennsylvania, North Dakota, South Dakota, Nebraska, Wyoming, Colorado, Washington and Oregon.

Supply of "early" potatoes for the northern markets comes from the southern states. About Christmas time, new potatoes begin to move from southern Florida. Cuba also ships early potatoes, starting in January.

Northern Florida, due to paucity of frosts and the early growing season, furnishes many northern cities with supplies of new potatoes. As the season advances, points of origin move northward into Georgia, South Carolina and North Carolina. By June potato harvest is under way in Maryland, then New Jersey, then Long Island in July. These areas specialize in early potatoes to command a good price, but their crops are all marketed by September, when potatoes begin to move from western New York and Maine. Freight costs keep most commercial potato-growing near the market.

Potatoes are perishable and long storage is difficult. Hence, there can be no carry-over of supplies from year to year as in the case of cotton, corn and wheat. All the production of a single year must be disposed of during that crop year. There is, of course, some competition between the early southern potatoes and the supplies from the late producing areas. The human consumption of potatoes is relatively stable.

The U. S. Department of Agriculture specifies the following six grades for potatoes:

U. S. Fancy	U. S. Commercial
U. S. Extra-No. 1	U. S. No. 2
U. S. No. 1	Unclassified

There are also size classifications for each grade with tolerance provisions. These grades and classifications are described in some detail in a pamphlet entitled, "United States Standards for Potatoes," issued by the Department of Agriculture.

The 100 pound sack is by far the most widely used container in marketing.

The methods of handling and distributing potatoes in the large city markets are somewhat different from those used for many other vegetable crops. Late-crop potatoes are used in larger quantities, are less perishable, and are subject to smaller price fluctuations from day to day than is true of many other vegetables. Carlot receipts of potatoes are often sold directly from the cars, on sidings or in railroad yards, to jobbers, peddlers, or large retailers. Large quantities are moved through the customary trade channels, that is, from carlot receiver to jobber to retailer. Some of the smaller dealers or jobbers who cannot handle a full carload of most commodities often buy carloads of potatoes.

Considerable trucking within the cities is necessary in moving potatoes from wholesaler to retailer. Some of this intracity movement is on trucks of wholesalers and jobbers, some on hired trucks, and some on retailers' trucks. One or two hauls, and occasionally three, are necessary in moving potatoes from rail yards or docks to the retail stores. Trucking rates vary among the cities.

Many carlot sales of potatoes are handled through city brokers who act for the country shipper in finding a city wholesaler, jobber, or large retailer who wishes to buy a car.

Brokerage charges are paid by the shippers. City dealers buy in various ways including "delivered" and f.o.b. shipping point. Many city firms have their own buyers in the producing areas. Some stock is received on consignment, particularly in periods of heavy supply. The commission charged shippers on consignment is usually from 7 to 10 percent. Chain stores buy large quantities of potatoes at shipping point for shipment by rail or truck direct to their city warehouses. Truck receipts of late-crop potatoes are important and are handled through jobbers, direct to retailers, and by peddlers.

On September 13, 1936, the Chicago Mercantile Exchange was designated a contract market to deal in potato futures under the provisions of the Commodity Exchange Act, approved June 14, 1936. Trading in potato futures has been conducted on that exchange in certain periods since 1931, although it is of minor importance in national potato marketing.

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Pounce

See Pumice

★ ★ ★

Praseodymium

See Monazite

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Prunes

THE prune is a variety of plum which, due to its high sugar content, dries without fermenting. Prunes are among the leading dried fruits of the world but some are also marketed fresh and some are canned. While produced extensively in France and the Balkans, the domestic market is supplied almost entirely by California, Oregon, Washington and (to a minor extent) Idaho. Prunes rank second only to raisins in the quantity dried. Crop marketing starts in September.

Prunes are used to some extent in baking and in confectionery manufacture and in preserve and jam making, but find their largest market as a staple article in the average diet.

They are purchased from the producer on the basis of the ton, and are sold by the pound. They are packed dried in 5, 10, and 25 pound boxes for the grocery trade, and in 1 and 2 pound cartons or Cellulose bags or bricks for the consumer trade.

Prunes are sold by size, the largest fruit commanding top prices. The commercial size range is from 15-20 to the pound to 120 or smaller. The California prune is of the French, or sweet variety, while those grown in Oregon and Idaho are of the Italian type, and are more tart. Prunes may be either sun-dried or processed by artificial heat before packing. They resemble the fresh plum in wrinkled and shrunken form.

Domestic production for the past five years follows:

	Tons
1937	255,700
1938	238,300
1939	213,400
1940	177,700
1941	188,400

Prunes were formerly shipped eastward by steamer, but now move by rail. They are subject to heat damage and weevil infestation, and require storage in cool places.

July, 1942, market values were:

	CENTS PER POUND	
	California	*Oregon*
20-30	9¼-9¾	....
30-40	8¾-9½	9
40-50	8¼-9	7½-8
50-60	8 -8½	7
60-70	7½-7¾	....
70-80	6¼-6½	....
90-100	5¾-6	....
100-120s	5	....

All the foregoing prices were f.o.b. Pacific Coast packing plant, for bulk prunes, packed

in 25-pound wooden or fibre boxes. Prices for consumer packages vary with individual brands. A marked trend toward the use of transparent wrapping has developed within the past six years in consumer packages.

Any other dried fruit in a comparable price range may be utilized as a substitute for prunes in time of scarcity.

During the first half of 1942 the prune market has been supported by purchases by the Agricultural Marketing Administration of the U. S. Department of Agriculture for lend-lease shipment and for domestic distribution on the food stamp plan. This buying will continue through the 1942-43 marketing season.

Import duties on prunes provide a tariff of 40 per cent on candied or crystallized prunes; duties of one-half cent per pound on green, ripe, or prunes in brine; 2 cents per pound for desiccated, dried, evaporated, or glace prunes; and 35 per cent on prepared or preserved prunes.

Prunes do not come within the scope of the General Maximum Price Regulation.

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Pulp

See Paper

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Pumice

A VOLCANIC glass, composed of minute cavities; frothlike, pumice is very light and, as a fine powder will float on water. The best grade pumice is ground and then graded for use for various purposes. The natural lump pumice is constituted of about 70 percent silica, about 15 percent alumina and about 5 percent of soda and potash. It is produced in California, Kansas, Nebraska, Oklahoma and Oregon and in peacetime comes largely from the Lipari Islands off Italy. Pumicite, a volcanic dust similar in composition to pumice, comes from Colorado, Kansas, Nebraska and Oklahoma.

Sales of pumice and pumicite in the United States in 1940 totaled 82,407 short tons, 8 percent under the record output of 89,159 tons in 1939 but considerably higher than in other years. The value of 1940 sales reached a new high of $449,914.

Sales of pumice and pumicite in 1940 for use in concrete (as admixtures and aggregate) increased 6 percent to 22,045 short tons compared with 20,719 tons in 1939. Consumption in other uses was less than in 1939 — cleansing and scouring compounds and hand soaps 49,359 tons in 1940 against 52,251 tons in 1939; and acoustic plaster 3,712 tons in 1940 against 5,444 (1939). In 1940 and 1941 uses for polishing metals increased substantially and formed a large part of pumice used. In California, plans for increasing production have been more ambitious than in other States. Demand for pumice for light-weight concrete blocks is reported expanding and studies are being made of the use of the material as a ceramic body constituent. Pumice, as a fine powder, is known as Pounce and is used in preparing parchment, tracing cloths, and for coating paper for polishing felt.

Ground domestic pumice, in mid-1942, was quoted at 3¼ to 5½¢ per pound, bag-packing, depending on the grade, the shipping quantity and the f.o.b. point. Pumice stone, packed in barrels, was ½¢ per pound higher than the above range.

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Pumicite

See Pumice

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Purified Ozokerite

See Ceresin

Purple Medic

See Alfalfa

* * *

Pyroligneous Acid

See Turpentine and Rosin

* * *

Pyrophyllite

PYROPHYLLITE, resembling talc in appearance and properties, with a description Hydrous Aluminum Silicate (H_2AL_2, (SiO_3)), is being produced and used more extensively recently. It is mined; crushed; ground and then air-separated to sizes ranging from 60- to 325-mesh. Recent research has resulted in its use with other materials as a ceramic-body ingredient in wall tile, in tableware, and as an addition in electrical porcelains. Uses include the dusting of rubber sheets, face and body powders, battery boxes, wall plaster, filler or diluent in insecticides. North Carolina has been the principal source of the product. The United States is the largest market for talc, pyrophyllite and ground soapstone in the world, using the entire domestic production. United States sales run about a quarter of a million tons annually, of which about 10% is imported (steatite and french chalk) mostly in a semi-finished form. Pyrophyllite is marketed in paper bags, priced recently around $10.00 per ton on a carload-lot basis. It is non-perishable.

* * *

Quartz Crystal (Brazilian Pebble)

BRAZILIAN PEBBLES are quartz crystals of exceptional purity and size, generally clear and colorless, often referred to as rock crystals. Occasionally they have a reddish, bluish, smoky or milk tinge. Quartz is silicon dioxide (SiO_2) and has a hardness of 7 while that of the diamond is 10. Grains in sand are often less than 0.04 inches but have ranged in size up to 20 inches. When quartz is fused, it loses its crystalline structure and becomes a silica glass with specific gravity of 2.2, compressive strength of 7,000 pounds per square inch and hardness of 5.

Although quartz is a most common and widely distributed mineral, Brazil has been the only commercial source of the high-grade crystals. Madasgascar, to some degree, produces a crystal inferior for many uses. Miners of feldspar and other minerals in the United States occasionally find quartz crystals, but the output is very small and is inferior in quality. Quartz crystals are listed as a "strategic material" by the Army and Navy Munitions Board.

The particular property of high-grade crystals, which largely accounts for their importance, is their piezoelectrical property or the faculty for generating an electrical potential when placed under stress. If a plate cut in a particular direction from a crystal is placed under tension or compression, an electric charge of measurable proportions is developed on the plate; conversely, if an electric charge is applied to the plate in a certain manner, there is an immediate change in the dimensions of the crystal. Considerable use, of a strategic nature, is also made of the optical properties of quartz crystals because of their crystallographic and light transmission properties, but only a small percentage of crystals are suitable for optical and piezoelectrical purposes. The crystals vary in size from a few ounces up to 100 or more pounds, the average crystal for piezoelectrical purposes weighing three pounds or more. The latter is the most economical size because it contains a fair percentage of useable material.

Prior to 1925, quartz crystals were used principally for ornamental purposes, only small amounts being diverted to optical uses, such as lenses or prisms for instruments, and

for the manufacture of articles or utensils of clear fused quartz. The strategic importance of these crystals dates chiefly from their use for radio frequency control, dating from the old "crystal" sets of the 1920's.

In recent years, manufacturers have sent their own agents to Brazil—from the U. S., Britain, Germany, Japan and others,—or established purchasing agents there, no longer relying on general exporters.

A few of the uses of the crystal—the disposition of which is now controlled by the War Production Board — illustrate its importance: Radio and television; telephony; depth-sounding and iceberg detection apparatus (where the crystal plate catches and measures directional waves reflected from the sea bottom or an obstacle); ballistics and defense devices (where the crystal measures the pressure developed by a propellent charge in a gun barrel, making it possible to predict the distance the projectile will travel); in devices to detect submarines and approaching airplanes; for measuring the detonation in airplane engines; and an extensive and necessary use in many precision instruments, in seismographs, periscopes, gun sights, polariscopes, accurate clocks. It is required for the manufacture of special water-clear lenses and prisms in making submarine windows, experimentally in the manufacture of large telescopes, and for making fused quartz articles such as tubes, tubing, rods and plates for quartz mercury vapor lamps, as well as for other scientific utensils. Finally, when in normal supply, it is used in the manufacture of cheap jewelry, ornaments, etc. When ground into grains or powder, the crystal is a valuable cutting and polishing material in the manufacture of glass and porcelain.

Most of the crystals found have defects which render them unsuitable for piezoelectrical and for some optical use. One of the most common flaws is that known as twinning, which can be detected only by special apparatus. Other materials are known to have this piezoelectrical property but they have certain other defects which make them unsuitable for radio frequency control. Rochelle salt—about 1,000 times as active as quartz — is soft and sensitive to moisture while Tourmaline, with its ability to vibrate at a higher rate, was found to be soft, high in cost and not uniform.

Brazil supplies the entire world with quartz but only about one-fourth the quantity is of the strategic grade. The war brought a jump in exports from 661,000 pounds in 1937 to 1,494,000 pounds in 1939. The business of crystal mining in Brazil is unorganized and does not lend itself to modern methods. Mining by U. S. companies on a lease-right basis has not proved satisfactory due mostly to the lack of efficient labor, and in addition in 1937 Brazil made it illegal for foreign companies to hold mining rights. Japan, through 1939, was Brazil's most important market for quartz crystal, taking 60 percent of the output but mostly of small low-grade crystals used in jewelry and some optical quartz. The United Kingdom, Germany and the United States, in the order mentioned, were the next best customers from point of volume. Deposits in Brazil appear extensive enough to supply world needs for many years.

There is considerable speculation in Brazil on the part of dealers who often travel long distances by primitive modes of transportation to obtain advantageous terms. Prices, as a rule, follow the form, weight and degree of perfection of the crystal. In general, pyramids sell at about 30 percent more than irregular crystals, and yellow, smoky or discolored crystals sell for approximately 20 percent less than the clear or rock variety. Quartz crystal enters the United States free of duty. In 1940, pyramid first-quality crystals for use by radio manufacturers, usually 2½ to 3 pounds each, sold for from $5.00 to $15.00 per pound at New York depending on the fineness. The war increased

the demand and the price, with Brazil only cut off from her normal German market.

On May 18, 1942 the War Production Board by Order M-146 provided that, except by specific authorization, quartz crystals may only be used for (1) implements of war as defined by Army, Navy, or other Government agencies or lend-lease (2) oscillators and filters for use in radio systems operated by Federal agencies or commercial airlines (3) telephone resonators. Purchasers must certify that products containing quartz crystals will be used only for these purposes. Holders of 25 pounds or more of quartz crystals, or ten pieces in a manufactured form not incorporated in a mounting, as of May 18, must report to WPB and consumers must report monthly. Sales of more than 10 pounds must be reported within ten days after the transactions, and imports must be reported within a similar period after importation.

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Quicklime

See Lime

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Quicksilver

QUICKSILVER or mercury is a silvery, liquid metal, sometimes found native but more often found as cinnabar, a mercurous sulphide. The metal is obtained from the sulphide ore by roasting. California, Oregon, and Nevada are the chief sources of the metal in the United States. Spain, Italy, Mexico, China, and Canada are the important foreign suppliers of the material.

Production of quicksilver in the United States during 1940 amounted to 37,777 flasks of 76 pounds. Of this quantity, California supplied 18,629 flasks; Oregon, 9,043 flasks; Nevada, 5,824 flasks; Arkansas, 1,159 flasks; and Arizona, Alaska, Utah, Idaho, Texas, and Washington, small quantities. In 1939, quicksilver production totaled 18,633 flasks. Imports of quicksilver into the United States during 1940 were 12,971 pounds; 9,698 pounds coming from Mexico, 3,042 pounds from Spain, and smaller amounts from Italy and China. In 1939, imports totaled 265,944 pounds, with 197,671 pounds being supplied by Spain, 42,745 pounds by Mexico, and 25,528 pounds by Italy.

In addition to the 76 pounds flasks, quicksilver is also packed in 5, 10, and 20 pound jugs, and in one-pound bottles. The most important use of the material at present is for the manufacture of mercury fulminate, which is used as a detonator in explosive charges. Normally, quicksilver finds use in the extraction of gold and silver from their ores, in thermometers and other apparatus; in mercury vapor and fluorescent lamps; and in the manufacture of mercury salts. The price of mercury on June 1, 1942 was $191 at the points of shipment in the Western states.

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Quinine

THE Japanese conquest of Java cut off the supply of cinchona bark, chief source of the world's supply of quinine. The 37,500 acres of trees on that Dutch East Indian island represented 90 percent of world production.

Quinine, like rubber, originated in South America and was later transplanted to the East Indies. In a short space of time the cultivated Oriental production supplanted the harvest from wild trees in the Western Hemisphere. In 1938, all but 6,500 pounds of U. S. imports of 1,349,000 pounds of cinchona bark came from the Netherlands East Indies, as well as most of our imports of 1,468,500 ounces of quinine sulphate and other quinine salts.

The British have started small cinchona

plantations in Jamaica and the United States in Puerto Rico but any immediate increase in supplies can best be brought about by encouragement of stripping of wild trees in South America.

The tree is slow in growing and has to be killed for removal of the bark.

Quinine is an alkaloid. While the Java bark contains 4 to 8 percent of the alkaloid (anhydrated), the South American bark contains from 1 to 4 percent. In appearance it is white, odorless, bitter crystal or crystalline powder which darkens on exposure to light and gradually loses moisture on exposure to dry air. The United States ranks quinine second only to opium in its list of critical drugs, because of its importance in treating malaria and other ills.

Atabrine, a synthetic competitor of quinine, is a derivative of coal tar discovered by German chemists about a decade ago.

In 1940, imports of cinchona bark and other barks from which quinine may be extracted reached a record total of 5,418,000 pounds against 2,030,000 pounds in 1939.

Imports of quinine sulphate and other quinine and salts amounted to 3,489,000 ounces, a decline from 1939 when imports totaled 3,705,000 ounces.

Quinine is rated in Class I by WPB, among commodities where the supply is inadequate for war and essential civilian uses.

The War Production Board by Order M-131, made effective April 4, 1942, restricted the purchase, sale and use of quinine, totaquine and cinchona bark. Quinine alkaloid and its derivative, quinine salts, were included; also, totaquinine, described as a mixture of alkaloids extracted from cinchona bark containing not less than 25% of combined quinine and cinchonidine, and not less than 70% of total crystallizable cinchona alkaloids; and "anti-malarial" agents meaning any product or material which, according to modern medical opinion, is recognized as a specific for the prevention, alleviation or cure of malarial infections.

In June, 1942, cinchona bark was quoted as follows: quills $1.15-$1.25 per pound; broken 26¢-30¢; clover tops 32¢-35¢; cocillana 21¢-22¢.

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Raffia

THIS VEGETABLE FIBRE is obtained from the raffia palm (Raphia ruffia) of Madagascar. The leaves of the palm are drawn across knives to produce the strips that find various commercial uses in this country. Principal uses are by farmers for binding of plants, vegetables, etc., and for basket making and weaving. The May, 1942, price list showed a variation of from 40¢ to $1.00 per pound. Although sold on a pound basis, it is usually marketed in hanks. Transportation normally involved a trip by boat from Madagascar to Marseilles to London to New York; the war caused sharp curtailment of imports. Principal types are "plain natural colored" and "dyed" for basket work.

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Raisins

THE raisin is a grape of a special type dried in the sun or by artificial heat. It contains a high sugar percentage and has a flavor quite different from that of the fresh grape. It is the largest in volume of all dried fruits. Crop marketing starts early in September.

While raisins are grown generally in the Mediterranean countries, the California raisin dominates the domestic market, particularly since imports were curbed or halted by the war. Raisins are used in large tonnage by the baking industry, to a considerable extent by confectionery manufacturers, and to a limited extent in the manufacture of ice cream. They are a staple item of diet

and sell in large volume to the consumer through regular grocery trade channels, mostly in package form.

The principal market grades are Thompson seedless, in both bulk and package; Muscats; sulphur bleached raisins, and Sultanas.

Raisins are bought by the processor from the grower on the basis of the ton and marketed on the basis of the pound or package. Bulk raisins are packed in 25-pound wood boxes, with the packaged raisin generally of the 15-ounce size, packed 48 to the case.

Domestic production, by varieties, for the past five years follows:

	TONS					
	Thompsons	*Muscats*	*Sultanas*	*Bleached*	*Misc'l*	*Total*
1937	188,405	27,769	6,130	23,436	2,536	248,276
1938	216,285	32,835	7,130	31,826	4,087	292,163
1939	178,249	25,322	5,200	33,676	4,715	247,162
1940	148,671	7,180	2,257	7,819	4,095	170,022
1941	175,770	12,106	2,393	15,119	4,538	209,926

While the California crop is normally shipped to eastern and interior markets by intercoastal steamer and rail, the disappearance of vessels from the intercoastal run has forced the movement to an all-rail basis.

Raisins are subject to both heat damage and weevil infestation; hence, they require careful handling and storage in a cool spot. They are also subject to mold, and their commerical life is not much beyond the crop year.

July, 1942, quotations to the trade were: Thompson seedless, 15-ounce packages, 8¼-9¼ cents; bulk, 7¾ cents; midget Thompson seedless, bulk, 7⅞ cents; choice seeded Muscats, 15-ounce package, 10-10¼ cents; bulk 10¼ cents; bleached, extra choice, 7½ cents; fancy 8-8¼ cents; extra fancy, 8¾-8½ cents.

Currants are a suitable substitute for raisins, but generally sell four to five cents per pound higher; so their utilization on a commercial basis is not practicable.

The import duty on raisins is 2 cents per pound.

Raisins come within the scope of the General Maximum Price Regulation.

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Rape Oil

RAPE or rapeseed oil is a fixed, nondrying or semi-drying oil produced from the seeds of a number of varieties of the turnip Brassica compestries. It is light-yellow in color, having an iodine value of about 100. The seeds from which the oil is obtained are exceedingly small, and consist of about 40 percent of oil.

The most important uses for rape oil are for lubrication and illumination. In countries where it is produced, it has an important edible use. In Germany, it is used as a salad oil while the natives of the East Indies use it in the preparation of curries and other hot dishes. For edible purposes, the oil is cold-pressed and refined with caustic soda. Sulphuric acid usually is used in refining nonedible oils. Rape oil is blown when used for special lubrication. This consists of oxidation by blowing air through the oil while hot.

In some years, small amounts of seeds are crushed in the United States but most imports come in the form of oil. Manchuria and India are important producers of the oil. The factory consumption of rape oil in 1941 amounted to 12,054,000 pounds.

Effective January 14, 1942 rapeseed oil was added to list A of strategic materials and imports were placed under government control. Under General Preference Order M-77, issued by the War Production Board on March 23, 1942, the use of rapeseed oil was restricted to the following uses effective April 1, 1942.

1. Marine engine oil, heavy machine engine lubricating oils and pneumatic tool oils.
2. Factice for compounding rubber.
3. Blown rapeseed oil.

The price of rape oil, drums, N. Y., aver-

aged 15.5 cents per pound in April 1942. Blown rape oil averaged 18.2 cents per pound.

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Rapeseed Oil

See Rape Oil

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Rare Earth Metals

See Monazite

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Rayon

THERE are three kinds of rayon in general use, "viscose," "acetate" and "cuprammonium." These names refer to the manufacturing methods used. Viscose production far outstrips all others. Acetate is next and cuprammonium third.

The raw material of rayon manufacture is the cellulose from specially treated wood pulp or cotton linters. It goes into the viscose mill in the form sheets like blotting paper and into an acetate mill as baled loose pulp. The fibre of the wood pulp or cotton has no relation to the final rayon fibre, as it goes completely into solution before spinning. Although there has been considerable research on various materials as possible sources for rayon pulp, the industry continues to use wood pulp and cotton linters because these materials have the purest cellulose in the most readily available state.

The following description of manufacture deals with wood pulp.

The first step in the manufacture of viscose rayon is the preparation of the wood pulp which is usually from woods such as spruce or hemlock.

On arrival at the pulp mill the logs are stripped of their bark, cut into small chips, and boiled under pressure with a solution of calcium and magnesium bisulphite. This removes the lignone, gums, and resins, and a comparatively pure but colored cellulose is obtained. The bisulphite solution is washed out and the pulp bleached, pressed into thick sheets, and dried to the desired percentage of moisture, after which the sheets are baled and dispatched to the rayon works.

The suitability of a pulp for viscose manufacture depends largely on its freedom from lignin and mineral matter, and on its content of cellulose insoluble in caustic soda solution. But other properties, such as its capacity for absorbing caustic soda solution and its viscosity when dissolved in certain solvents, are also important in affecting the uniformity of the rayon to be produced.

As the consignments of pulp arrive at the rayon factory samples are taken and submitted to chemical analysis, and, if the results are satisfactory, the consignments are passed to the pulp storeroom. Here the humidity is kept as constant as possible, so as to assure a uniformity of moisture in the sheets. As required, the bales of pulp are taken from the storeroom and the large sheets cut into smaller ones of a convenient size. A definite weight of these is then placed in perforated steel boxes in a steel tank and a solution of caustic soda, of sufficient strength to produce mercerizing, is run in until the sheets are fully covered.

When the penetration of the caustic soda is complete the solution is drained off and the wet pulp pressed till it contains the desired proportion of soda. The mixture of soda and cellulose thus obtained is milled in powerful grinders into the form of fine white flocks, or, as they are usually termed, "crumbs." It is frequently the practice to pack these crumbs in boxes and keep them to mature, the temperature and time of maturing, together with the quality of cellulose employed, determining the viscosity of the solution ultimately produced.

The matured alkali cellulose is transferred to a hollow horizontal cylinder or

churn capable of rotation round its axis, and here it is treated with a carefully measured quantity of carbon bisulphide, which combines with the alkali cellulose to form an orange colored mass termed xanthate. As soon as the treatment is complete the last traces of carbon bisulphide are removed by blowing a current of air through the churn, and the xanthate is transferred to a large tank provided with rotating paddles, where it is dissolved in water or a weak solution of caustic soda, to form the liquid "viscose." This liquid has been given the name of "viscose" by its inventors, Messrs. Cross, Bevan, and Beadle, because of its high viscous nature.

The viscose-liquid is now cooled to a low temperature by means of refrigerated brine and then passed into cold rooms of regulated temperature, where it is filtered several times through fine calicoes to remove undissolved fibres and the small particles of dirt which may have been picked up in the course of the process. It is then placed under a strong vacuum to extract the air bubbles produced in the solution by the violent agitation in the mixing and filtering processes. When quite free from air the viscose solution is fed by pressure to the spinning machines, where it is collected by small mechanical pumps and forced through platinum nozzles into a coagulating solution. Each of the platinum nozzles is perforated by a number of holes, corresponding to the number of filaments which are to form the ultimate thread.

The coagulating solution consists generally of sulphuric acid and sodium sulphate, but sometimes ammonium sulphate and glucose are also added.

As the viscose meets the acid solution it is quickly coagulated, and the jets of liquid viscose are converted into fine filaments of regenerated cellulose strong enough to be drawn out of the bath and wound up on some convenient form of collector.

It has been the usual practice in Europe to draw the thread direct on to a large bobbin of glass or a metal which will resist the corrosion of the acid bath, and then, after they have been washed and dried, to twist them by the methods adopted for natural silk.

In England and the United States a different process has been adopted. The thread, after leaving the coagulating solution, passes under a guiding hook, over a revolving drum and down through a vertical reciprocating tube into a cylindrical box, known as the Topham box. This box rotates rapidly on a verticle spindle, and the centrifugal force so developed throws the thread to the sides of the box, where it builds up into an annular cake, the required amount of twist having been imparted by the rotation of the box at several thousand turns per minute.

Experts cannot agree as to the relative merits of the two spinning processes, viz., the bobbin winding and the centrifugal box processes, but there is no doubt that the simplification of the process by the use of the centrifugal box played a large part in the successful development of the viscose rayon process in the United States.

When sufficient thread has been spun into the cylindrical box the latter is stopped and the annular cake of viscose thread taken out and wound into skeins of definite length. The skeins are then laced with tie bands, some of which are colored for the purposes of identification of the various deniers in process of manufacture, and passed along to the washing machine. Here the skeins, supported on aluminum rods, are carried automatically through a falling spray of clean, warm water, which removes all the chemicals of the spinning bath and leaves a nearly pure cellulose thread. (An abundant supply of clean water containing very little mineral salt is essential for viscose manufacture.) Before the rods are taken from the washing machine the skeins are tested with a chemi-

cal indicator (for freedom from acid). The rods are then placed on frames and the skeins, through which is passed a warm current of air of regulated humidity, are dried.

The skeins which come out of the drying stoves are harsh and dull, due to a small amount of sulphur which was precipitated in the thread when the viscose came into contact with the acid of the spinning bath, and to remove this they are subjected to a washing treatment with a hot solution of sodium sulphide, in which the sulphur is completely soluble. The solution of sodium sulphide is then washed out and the skeins are bleached to the desired degree of whiteness, after which they are again washed. Whizzing in a centrifugal hydro-extractor removes the excess of water, and the skeins are then dried loosely on rods in a warm current of air.

The skeins which come from the drying room are soft and lustrous and ready for the dyer, knitter, throwster, and weaver, but before being bundled ready for shipment, each skein is carefully examined and graded according to the amount of broken filaments which it contains.

The rayon is then doled and bundled under pressure in packages of approximately 10 lb. weight. The exact weight of the rayon depends upon the moisture it contains, as in common with all textile fibres the amount of moisture absorbed varies with the atmospheric conditions.

In the manufacture of acetate rayon, the purified cellulose pulp is treated chemically and placed in a kneading machine. The resulting thick solution is aged in tanks. Water is added, carrying off the free chemicals and causing cellulose acetate to precipitate. This cellulose acetate when dried resembles clean white rice and can be stored indefinitely until required for spinning. When needed these solid particles are dissolved in acetone and filtered several times to remove even microscopic impurities. In the form of a thick liquid it is forced through a spinneret. A current of warm air evaporates the acetone (which was used as a solvent) leaving a group of fine filaments which are wound on a spool or bobbin in the form of thread. The yarn on the bobbin is a finished product, requiring no washing or bleaching. It can be put up at once in the form desired by the knitting or weaving mill.

Differing from rayon which is twisted into yarn as the filaments leave the spinneret, spun rayon is made by drawing the filaments from many spinnerets together without twisting and cutting them into definite lengths known as rayon staple fibre. The length and diameter of these staple fibres can be varied, according to the purpose for which the yarn will be used. Washed, bleached and dried in a continuous operation, the fibre is then shipped in bales to the yarn spinner, where it is made into yarn on cotton, silk or wool spinning machinery and is then termed spun rayon yarn.

Either bright or dull in luster, spun rayon has a versatility that has proved an important factor in broadening the textile field. It resembles cotton, wool, linen or silk, according to the size of filament and the method of spinning. It can be spun and woven into soft challis or heavy suitings, fine lace or heavy plush; and it goes into a great number of blends with other fibres, either in the yarn spinning or in the fabric weaving, to produce variations impossible with one fibre alone.

Although spun rayon is made of both viscose and acetate, the viscose type predominates. The two may be blended to make heather mixtures or two-color effects. Spun rayon makes excellent sport and wash fabrics, and prints in clean-cut colors.

The use of spun rayon is spreading rapidly, and this fibre promises to become even more popular in a few years than the older type of filament rayon.

Cuprammonium yarn products have become an important item in the field of man-made fabrics, due mainly to its suitability for processing of a filament of extreme fineness and high quality that also dyes very well.

Virginia, Tennessee and Pennsylvania have the majority of the rayon plants although there are some in Ohio, Maryland, Georgia and a few smaller plants in other States.

U. S. production of rayon filament yarn in 1941 amounted to 451,204,000 pounds. Rayon staple fiber output amounted to 122,-025,000 pounds.

Most rayon yarn in normal times goes into the broad rayon cloth weaving field. It also is used in narrow woven goods, such as ribbons and tapes, in knitted underwear and in tire cords.

The war has placed added strains upon rayon supplies. Filament yarn has been needed to replace both silk and nylon in civilian goods. Staple fiber has been used in place of flax and wool in a number of cloths. A considerable portion of the nation's output of rayon materials was needed by the Army and Navy. In addition, shipments were made to the Latin American nations under the Good Neighbor program.

The marketing unit is the pound. Under the terms of Maximum Price Regulation No. 167, effective June 27, 1942, ceilings were established as follows:

(1) *Acetate Process Continuous Filament Yarns.*

CONES AND SPOOLS

Denier	Low Twist Under 2 turns per inch	Regular Twist Over 2 and under 6 turns per inch	Skeins
45	$1.02	$1.07	$1.16
55	.93	.98	1.07
65	.86	.90	.97
75	.76	.80	.88
100	.70	.73	.80
120	.65	.65	.71
150 and coarser	.56	.56	.61

The following premiums above the maximum prices are set forth in subparagraph (1) for first quality continuous filament yarns shall be allowed:

(i) 1¢ per pound on all deniers for each turn per inch over five turns per inch;

(ii) 5¢ per pound for tinted cones; and

(iii) 10¢ per pound for spun dyed black yarn.

(2) *Cuprammonium Process Continuous Filament Yarns.*

CONVERTER SKEINS AND CONES

Denier	Skeins (No twist)	(Twisted up to 6 turns per inch on 40 and 50 denier yarns) (Twisted up to 5 turns per inch on 55 denier or coarser yarns)
40	$1.40	$1.55
50	1.10	1.25
55	...	1.07
65	.95	1.05
75	.90	.98
100	.73	.79

(3) *Viscose Process Continuous Filament Yarns.*

Denier	Skeins	Weaving and Knitting Cones
40	..	$1.20
50	$1.05	1.10
65	.95	.98
75	.85	.88
100 (60 filaments and less)	.73	.75
100 (More than 60 filaments)	.75	.77
125	.66	.68
150 (Less than 60 filaments)	.55	.55
150 (60 filaments or more)	.57	.57
200	.52	.52
250	.51	.51
300 and coarser	.49	.49

The following premiums above the maximum prices set forth in subparagraph (3) for first quality continuous filament yarns shall be allowed:

(i) 4¢ per pound for 6 turns per inch on 150 denier or finer yarns;

(ii) 5¢ per pound for 7 turns per inch on 150 denier or finer yarns;

(iii) 5¢ per pound for dark tinted cones; and

(iv) 10¢ per pound for spun dyed black yarn.

(4) *Rayon Staple Fiber*

VISCOSE PROCESS	Price per lb.
All deniers, all lengths	
Bright	$0.25
Dull	.26
ACETATE PROCESS	
8 denier or finer, all lengths, bright and dull	
Untinted	.43
Tinted	.45
Coarser than 8 denier, all lengths, bright and dull	
Untinted	.45
Tinted	.47

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Red Fir

See Douglas Fir

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Red Gum

See Hardwoods

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Red Oxide of Iron

AN IMPALPABLE powder, which is essentially pure ferric oxide (Fe_2O_3), minor constituents being held to minimum proportions. It is produced from copperas (ferrous sulfate). Its principal use is in the coloring of rubber and cement, and in paints, inks and linoleum. It is marketed by the pound, recently priced at 9¾¢ per pound f.o.b. plant. Distribution is in barrels and bags, by rail and motor truck. The "chemically pure" grade is the only one marketed. Earth colors are rated as substitutes. There is a 15% ad valorem duty on imports from England and Canada; 20% from other countries.

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Red Peppers

See Capsicum

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Redwood

REDWOOD, almost wholly from California, like many of the lumbers has had an increased demand to replace other critical materials. The Redwood Association, representing 95 percent of the total cut, reported a 1941 cut of 463,000 thousand board feet as against 364,000 thousand in 1940, despite the drop in residential building.

Redwood has been reported used for wooden sidewalks, for water, oil and chemical storage tanks, and as pipes to replace copper and iron. Cribs for grain storage is another use which has cropped up as a result of war shortages. Caskets and ice boxes are other uses for this slow-decaying wood. Finally, in packaging redwood is replacing tin, cardboard and aluminum foil.

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Refractory Brick

DIFFERENT from the building brick are the refractory brick, used by the heavy industries. The iron and steel industry takes half the refractory sales, public utilities 20% and non-ferrous metals, cement and lime, glass, oil refining and ceramics most of the rest. They go into furnaces, pits, boilers, ovens, gas producers, stoves, incinerators, locomotives, etc.

Furnace linings and other "refractories" are designed primarily to withstand high temperatures. But a good refractory must

also withstand "slagging" (chemical action), abrasion, and spalling, and other consequences of heat, including softening or incipient melting. A refractory must stand slow heating up to 1500° C. (2732° F.) without showing signs of fusion.

The standard refractory brick is 9″ by 4½″ by 2½″ but there are many other so-called standard shapes.

Most refractories now used are first-quality fireclay brick. They combine flint clays that are refractory but not plastic, and highly plastic clays that are only moderately refractory. The materials come mainly from Pennsylvania, Kentucky, and Missouri. Immense deposits of kaolin in Georgia are also used.

They are good enough for blast furnaces, hot-blast stoves, checker chambers for open-hearths, steam boiler settings, etc., but not refractory enough for high-temperature boiler installations or oil stills. Here high-alumina brick are usually needed, made from combinations of plastic and flint clays, burleys and diaspores, mostly from Missouri. Fifty percent alumina brick has been substituted sometimes for first-quality clay brick in boiler furnaces. Sixty percent alumina brick have been substituted widely for fire-clay brick in boiler furnaces firing both oil and coal, particularly powdered coal; they are also used where refractory structures are under heavy load at high temperature and fire clay brick tends to deform.

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Rennet

RENNET is a meat industry by-product, the contents of the stomach of an unweaned calf or other animal, or the lining membrane of the stomach of ruminants. It is used for curdling milk, in cheese manufacture, and to some extent in the manufacture of dessert preparations.

Rennet is handled principally in liquid form commercially in the United States, although widely prepared in powder or tablet form in Europe. Domestic production accounts for the bulk of the business in this product in the United States.

The product is packed in 5, 10, and 24-gallon kegs, the trading unit being the gallon. The July, 1942, market value was $4 per gallon.

Keeping qualities of rennet are limited, and it must be stored cold. It rapidly loses its properties when heated above 60° C.

There is no substitute for rennet.

Liquid rennet is admitted to the United States duty-free. A tariff of 25 per cent is imposed upon imports of rennet tablets.

Rennet comes within the scope of the General Maximum Price Regulation.

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Rensselaerite

See Talc

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Reptile Skins

REPTILE SKINS are obtained from various species of alligators, snakes, and lizards and are used for making a variety of popular leathers for shoe uppers, trimmings, handbags, and a variety of fancy leather goods.

Alligator skins are obtained mostly from the Florida Keys, the swamps and lagoons along the Gulf of Mexico, Cuba, and the fresh water rivers of Central America.

The alligators are killed by shooting, clubbing, or harpooning. They are skinned immediately after killing and the skins are preserved with salt until they reach the tannery, where they are softened, tanned by a special process, glossed, and trimmed. Alligator skins have been tanned successfully for a number of years, the bellies being used for shoe leathers and similar types of leathers, and the hard backs being made into luggage leathers.

There are 2,500 known species of lizards

but only a few are used for making leather. These come chiefly from Java and India and are commercially identified by the country or district in which they originate or by the species of lizard from which they are secured.

Lizards are killed by being picked up by the tail and knocked on the head, the skins are removed immediately after killing, salted, and removed to a central shipping point where they are further processed for preservation during shipment to tanneries.

Only a few of about 2,500 known species of snakes are used for making snakeskin leathers. These include the vicious cobras, pythons and boas, and the harmless karuns or watersnakes that abound in Java, Siam, Borneo, and the Straits Settlements. The skins are treated for shipment in much the same manner as lizard skins and are softened, dyed, smoothed, and glazed by special processes in the tannery.

All reptile skins are sold by the piece, the price depending on the size, quality, and marking of the skins. Reptile leathers are commonly sold by the inch or by the piece, the price fluctuating greatly according to the size, quality, and attractiveness of the skins.

All reptile leathers are in considerable demand for "high style" uses, although production and consumption varies considerably from year to year with the varying trends of fashion. Each reptile leather is distinctively marked and patterned and these markings and pattern grains are frequently simulated by embossing cattlehide, goat, and other leathers.

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Rhodium

One of the lesser platinum metals (Rh), Rhodium is, like platinum and its allied metals, characterized by a high melting point (3542° F.), whiteness, and resistance to oxidation at high temperatures and to attack by destructive chemical compounds.

While insoluble in most acids, it is susceptible to chlorine and sulphur. It has a specific gravity of 12.44, is extremely hard, and is one of the most infusible of metals.

It is alloyed with platinum for high-melting-point thermocouple wire, furnace windings, and laboratory ware for certain special applications. As a catalyst, it is employed to produce sulphuric acid and for ammonia oxidation to produce nitric acid and nitric oxide. Rhodium plating is used as a finish for glassware and silverware and in surfacing reflectors for searchlights and projectors. Platinum-rhodium spinnerets are finding wider use in the production of rayon because of their resistance to the various corrosive agents used. The metal is malleable at temperatures above 800° C.

Rhodium is sold by the troy ounce, being quoted recently at $125. In 1940, sales of iridium, osmium, rhodium and ruthenium totaled 14,593 troy ounces. Imports of rhodium and ruthenium during that year were 5,034 ounces, coming mostly from Canada and the United Kingdom. Rhodium represented only 4/10ths of 1 perecent of South African sales of platinum products in 1939, and, in the first seven months of 1940, represented only 0.64 percent of total sales.

The War Production Board, through Order M-95, effective March 11, 1942 prohibited the sale, purchase or use of Rhodium salts, or solutions thereof, for use in the electroplating or deposition of rhodium upon articles of jewelry.

In an interpretation of the Order, made April 17, 1942 the term jewelry was defined as including silver deposit glassware. "Rhodium" means Rhodium metal in any form including primary, secondary and scrap while "Rhodium alloy" means any mixture of metals containing more than 1/10 of 1% of rhodium in the form of sheet, wire, or semi-finished findings, or in any other form including primary, secondary and scrap.

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Rice

RICE is one of the most important food grains of the world. Although it occupies a minor position in the western world, it constitutes the staff of life for the teeming millions of Asia.

In the United States, the crop is produced under irrigation. The important factors in production are a constant supply of fresh irrigation water, suitable soils and a mean temperature of about 70° F. or above while the crop is growing. Seeding usually takes place in April and May and the growing season lasts from four to six months. Farm machinery is used extensively.

The rice grain consists of four parts—the outer husk, the cuticle or inner skin, the kernel, and the germ. All parts of the rice are valuable, including the husk which is used as fuel for the mill. After the grain is cured and threshed it comes to the mill as rough rice, or "paddy." Most mills in the United States are located near production areas. The rice is prepared for market by removing the husks and cuticle. The rice is polished, giving it an attractive appearance. The only other value of the polishing is to protect the rice surface and save it from deterioration. The removal of the cuticle to obtain the white rice removes part of the protein, fat and mineral matter and some part of the Vitamin B. However, polished rice still remains valuable and nutritious. The consumer may also obtain brown, or unpolished rice.

The leading producing nations in the world are China, India, Japan and Korea, French Indo-China, Siam, Java and Madura. World production, exclusive of China, averaged about 133 billion pounds in the five years prior to the war. Most of the rice grown in the Far East was consumed at home. Burma, Siam and French Indo-China were surplus producers but most of the other Far Eastern countries had to import. In average years, the principal importing nations are China, British Malaya, Ceylon, Netherlands India and Japan. Production in the U. S. is of minor importance, averaging about 1½ billion pounds annually. The important producing states are Louisiana, Texas, Arkansas and California.

Rice is used primarily as a human food, like wheat, although the carbohydrate content is higher and the fat content lower than in wheat. In addition to use as a food to accompany meat, etc., rice is also used for puddings and breakfast foods. The brewing industry is an important outlet for broken rice. Starch is another product of rice. The by-products in milling are used for animal feed.

Blue Rose is the leading type of rice produced in the south. Other important varieties are Early Prolific and Rexoro. The most important California varieties are Caloro and Colusa.

The marketing unit is the pound. The price for Blue Rose early in June was 8¼ cents per pound at New York. The duty on rice paddy is 1¼¢ a lb.

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Riprap

See Granite

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Rosefish

NEXT in importance to New England's cod and haddock comes the once lowly rosefish. For years this fish was considered one of the "trash" fish of the North Atlantic—plentiful but of no market value. Along came filleting and packaging of seafoods and rosefish jumped from a trash fish to one of the highly prized fish of the North Atlantic with great fleets of vessels devoted entirely to their production.

The following table gives a very good picture of the rapid growth of the rosefish production.

Year	Pounds	Value
1930	85,170	$ 1,622
1931	120,287	1,152
1932	57,230	521
1933	250,075	2,639
1934	1,841,451	18,786
1935	17,110,497	183,704
1936	66,591,559	963,642
1937	58,327,219	887,565
1938	64,704,328	786,022
1939	78,206,000	1,104,000
1940	85,270,000	1,273,000
1941	139,352,785	....

The 1941 production hit a new high and unquestionably a new value as well, although figures on the value of this production were not yet available at this writing. A still higher record was anticipated for 1942. The war has had little affect on rosefish production, as yet. Most of the rosefish draggers are the smaller craft, not so greatly desired by the navy, and the fish themselves are found comparatively close to ports. Although there were reports of some rosefish draggers sunk by submarines, there was no sign of any great drop in production other than customary seasonal and fluctuating catch changes.

The great bulk of the rosefish catch is landed at Gloucester, Portland, Me., and at Boston. Gloucester is the leading rosefish port with "million pound landings a day" not at all uncommon.

During 1939, Maine produced 893,252 pounds of fresh and frozen packaged rosefish with a value of $73,968. Massachusetts produced 23,209,977 pounds, valued at $2,319,742. The total amounted to 24,103,229 pounds valued at $2,393,710.

The 1940, Maine produced 1,094,016 pounds valued at $98,186, and Massachusetts had 21,920,197 pounds valued at $2,174,699. The 1940 total production was 23,014,213 pounds, valued at $2,272,885.

Of this 1940 production, 639,149 pounds went into fresh fillets and 22,373,064 pounds went into frozen fillets.

The great production in the frozen packaged state is due to increasing popularity in its greatest market, the Middle West. It is an ideal package for fish sandwiches, "fish and chips," etc.

Rosefish average weight, packaged and in the round (a few thousand pounds are sold round) is about one pound. Fresh fillets are packed in 10 to 30 lb. packages while the frozen are packed 5 to 25 pound wooden and fibreboard packages. Shipments are made by refrigerated trucks, railway express and by refrigerated cars in carload lots.

Fillets are packaged in vegetable parchment wrappers, both plain and colorfully printed and also cellophane, also plain and colorfully printed. Waxed, cardboard boxes of 1-lb. size, are also used in connection with cellophane and parchment.

The rosefish is orange to flame red in color and, as befits its place as a northern fish, it has an increased number of vertebrae, thirty-one to be exact, and the dorsal fins number fifteen. Its large black eyes also give it the name of Northern Haddock. Other trade names include: red perch, sea perch, bream and red bream, also, redfish. The Latin name is Sebastes marinus.

The large head and excessive bones made it very unpopular as a food fish until fillets came along to solve the problem. The rosefish is perch-like in appearance, one-third as deep as it is long and has a large boney head.

They are caught on both sides of the North Atlantic and are a very popular food fish in Europe.

In filleting, sometimes over 60% is waste as only the fleshy sides of the fish are free of bones. Over 99% of the rosefish are caught by draggers.

The rosefish is a splendid example of what can be done with the little known and so-called

trash fish when properly packaged and merchandised.

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Rose Oil

ROSE OIL is also known as otto of roses and attar of roses, and is a yellow, or green liquid, according to its source. Bulgaria is the principal site of oil production, where the red rose, Rosa damascena, and to some extent the white rose, Rosa alba, are steam distilled. Rose oils are also produced in the Antalia region of Asia Minor, and in France. The Anatolian oil is said to compare in odor with the Bulgarian oil, while the quality of the French oil is considered slightly below the Bulgarian, although the French variety is sweeter and more penetrating. Numerous artificial rose oils are also commercially offered. The imitations in most cases are fortified with amounts of natural rose oil, since no exact duplication has as yet been artificially developed.

Imports of rose oil in 1940 amounted to 39,812 ounces, valued at $245,256. Bulgaria supplied 33,243 ounces, valued at $208,975. In 1939, imports were 66,551 ounces, valued at $411,903. Bulgaria in 1939 exported 49,042 ounces to this country; France 14,325 ounces; and the United Kingdom 2,236 ounces. Commercially the genuine Bulgarian rose oil is packed in 8, 16, and 32-ounce copper flasks, and one-ounce bottles. The synthetic oil is offered in one-ounce and one-pound bottles.

In the main, rose oil is used in perfumes. Its use in flavors is limited. On June 1, 1942 the price of natural rose oil was from $25.00 to $30.00 per ounce. On January 1, 1942 the oils ranged from $28.00 to $30.00 in cost, according to quality. At the same time in 1941, they were quoted at from $5.50 to $22.50 per ounce. Synthetic rose oil on June 1, 1942 was priced from $4.00 upward, according to quality.

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Rosemary Oil

ROSEMARY OIL is a colorless or pale yellow oil distilled from the flowering tops, or from the leaves alone, of Rosmarinus officinalis. Rosemary is indigenous to the area surrounding the Mediterranean, and the principal sources of the oil are Spain, France, North Africa, and the Dalmatian Islands. The French oil is considered superior to the Spanish oil. The United States Pharmacopeia in its monograph on Rosemary oil specifies that it contain not less than 2.5 percent of esters calculated as bornyl acetate, and at least 10 percent of total borneol, free and as esters. A technical grade of rosemary oil is also common in the trade.

The amount of rosemary oil imported into the United States in 1940 was 331,337 pounds, valued at $150,668. Spain supplied 287,823 pounds; Morocco 21,419 pounds; and France 16,392 pounds. In 1939, 76,256 pounds of the oil, with a valuation of $34,848, were imported. In that year 31,654 pounds came from Tunisia; 22,274 pounds from France; and 14,653 from Spain. Commercially both the U.S.P. and technical rosemary oils are packed in drums containing approximately 400 pounds, and tins holding 50 pounds.

Rosemary oils are used in medicine, and industrially in perfumes. The price of Spanish rosemary oil on June 1, 1942 was $2.10 per pound. At the start of the year the price was $1.80; and in January, 1941, the price was 65¢ per pound.

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Rosewood

ROSEWOOD is a tropical tree producing logs of 8 to 18 inches in diameter. It is cut in the forests of Brazil, India and Ceylon but, with the war, all cuttings were halted except in Brazil. During 1941 Brazil shipped to the United States approximately 2,000 tons. While

the wood varies with the slightly different species from the areas mentioned, it is usually dark brown in color, a hardwood, and takes a fine polish. It is used in fine furniture and cabinet work, cutlery handles, musical instruments, brush backs, and for novelties. It is marketed by the long ton. The 1941 price, ex-dock New York was $55.00 per ton but increased shipping costs and the tight shipping situation have affected the price and imports since then. It keeps well for about a year. Principal types are: Veneer logs, Lumber logs, and Cutlery logs. There is no U. S. import duty.

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Rosin

See Turpentine and Rosin

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Rubber

PROBABLY no industry was more affected by the War than was rubber, which saw virtually its entire source of the crude supply suddenly cut off by the Japanese occupation of Malaya, Netherlands East Indies and neighboring areas, which altogether normally produces more than 90 per cent of the world's output.

The U. S. Government immediately stepped into the picture to explore the possibilities of domestic production of synthetic rubber from petroleum and stimulation of crude rubber cultivation on the western hemisphere. An official production program, financed by the RFC, kept expanding until by mid-1942 the synthetic rubber goal had been put at 800,000 tons. In addition, efforts were being made in behalf of guayule, a native grown rubber plant. Guayule is discussed in a separate article.

The leading synthetic rubbers, expected to provide the bulk of production, were Buna-S, Butyl and Neoprene. These are discussed separately in this volume. In addition to the above types, it was planned to process additional synthetic rubber from butadiene from alcohol distilled from grain.

However, in 1942 there was an immediate problem that had to be solved and the citizens were called on to collect scrap rubber as a patriotic duty. Reclaimed rubber once again assumed the great importance it traditionally achieves in time of high crude prices or shortage.

Although the normal importation of crude rubber was all but forgotten, we feel it pertinent to discuss the crude product in this volume.

Rubber comes from a milky substance called latex, obtained principally from the tree "hevea braziliensis." The trees are tapped by cutting a small strip from the bark; the latex is collected in buckets. It is not the sap, but a liquid contained in the bark of the tree. It is coagulated by exposure to the air, speeded by acetic acid, and the curd-like substance is run through rollers to obtain sheets of pure rubber, which are dried (and sometimes also smoked) and baled for shipment.

Rubber trees require a warm, moist climate, with deep soil of good physical texture. Annual rainfall of 70 inches is sufficient; over 100 or 120 inches of rainfall is considered too high, especially as rain in the morning during the tapping hours is common in such high-rainfall countries, and morning rains limit tapping operations and the production of the estate.

The highest altitude for rubber plantings is generally considered to be 1,600 feet, although there are some producing estates at high elevations where no difficulty is experienced from frost. In recent years, new plantings above a thousand feet are rare.

The economic life of the rubber tree is as yet unproved—trees have been known to be high-yielders at the age of 40 years if given proper care.

Prior to the war, rubber was under inter-

national production control, which began in June, 1934.

World production of crude in 1940 amounted to 1,390,000 tons. Malaya produced 540,000 tons, followed by the Netherlands East Indies with 536,000 tons. Other important producing areas were Ceylon, French Indo-China, Thailand and Sarawak.

Before the United States entered the war, about 75 per cent of the rubber consumed here went into the manufacture of automobile tires and tubes. Other important uses were in the manufacture of mechanical rubber goods, boots and shoes, etc. Its commercial use in manufacturing was constantly widening. Recent important developments were the use of rubber in its liquid form (latex) as in the spraying and dipping of textiles to make them waterproof; and the use of sponge rubber in automobiles and furniture to replace springs and padding.

However, after the United States entered the war, consumption was diverted exclusively to war production and to the most vital civilian needs such as bus and truck tires and certain industrial, medical and health items. Most of the nation's rubber went into such military uses as production of tanks, trucks, planes, gas masks, pontoon bridges, pneumatic rafts, etc.

The traditional marketing unit for crude rubber is the pound. Prices of ribbed smoked sheet plantation rubber in New York averaged slightly more than 20 cents per pound in 1940.

Crude rubber is packed for shipment in wooden cases or burlap bales, according to terms of contract between producer and customer.

The maximum quantity of ribbed smoked sheets packed in a bale is 250 pounds net per 5 cubic feet. Each bale must be completely wrapped on all sides and corners with an equal quality of rubber, and not more than three-fourths pound of talc per package is permitted for compulsory dusting. Before covering with burlap, each bale is strapped by using at least three iron bands on outside of wrapper sheets of a minimum width of five-eighths inch, preferably of galvanized material. Wire is not permitted to be used for this purpose. New 12-ounce Hessians are used for covering, although second-hand rice or sugar bags without holes or patches are considered satisfactory. All burlap is required to be liberally coated with a mixture of sago flour, water, and silicate of soda to prevent the covering from adhering to the rubber. Burlap must be properly dried before using.

Within the last few years a method of packing ribbed smoked sheets in a bale covered on the outside with an equal quality rubber and by no other material or straps, has been used with considerable success. The rubber sheet is weighed to the amount of about 242 pounds, after being folded and cut to a size of 22 by 18 inches and piled evenly. A baling machine now presses the folded pile of sheets tightly together, and clamps to hold it secure are placed around it for a period of one-half hour, after which time the clamps are removed and the rubber retains its pressed form by reason of its natural adhesiveness.

Latex, in liquid form, is shipped in drums of 25 or 50 Imperial gallons or in bulk in tanks of steamers. In bulk shipments, use is made of railroad tank cars, barges and lighters with tanks and compressed air or pumping apparatus, latex bulking and loading stations on railroad spurs at wharfside, and other facilities somewhat similar to those used in the transportation of petroleum products.

Before the war, the generally accepted position of reclaimed rubber in rubber manufacture was as a compounding ingredient, and it competed with natural rubber only at times of high rubber prices, when manufacturers used higher percentages of reclaimed rubber in attempts to reduce the price of the

finished article. In 1917, owing to scarcity of rubber brought about by the World War, the United States consumed about 57 percent as much reclaimed rubbber as natural rubber, or 89,000 tons of reclaimed rubber to 157,000 tons of natural rubber. Economy of use of reclaimed rubber may be seen also in times of fairly low rubber prices; for instance, in 1935 when crude rubber fluctuated between 11 and 13 cents per pound, while reclaimed rubber was fairly steady at 7 cents a pound. Similar comparisons may be made for later years.

Economy was perhaps the first consideration in the use of reclaimed rubber. The industry originated and developed at times of high rubber prices, when it would have been unjustifiably wasteful to have discarded worn rubber shoes, for instance, if the rubber in them could be made to serve its time again. In this respect of conservation and reclamation, the reclaiming industry makes a worth-while contribution to the country. For some uses involving exposure to light and weather, reclaimed rubber is said to be more durable and hence preferable to new rubber.

The war emergency in rubber supplies makes reclaimed rubber tremendously important. Production in the five years, 1937-41, averaged about 190,000 tons annually but will be considerably above that figure in 1942. Limiting factors are the amount of scrap that can be collected and production facilities. The early estimate on total reclaimed production for 1942 was 340,000 tons. However, this figure may ultimately be raised.

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Ruby

See Corundum

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Rum

See Distilled Spirits

Ruthenium

ONE of the rarer metallic elements, ruthenium (Ru), like osmium, iridium and rhodium, is obtained in the mining of platinum.

It is characterized by a high melting point, about 4440° F., whiteness and resistance to attack by destructive chemical compounds. The specific gravity is 12.1.

As a residue of platinum ore, it generally occurs admixed as a metal with osmiridium.

Ruthenium is sold by the troy ounce, averaging about $35 to $40 per ounce. Sales of all platinum metals in the United States in 1940 totaled 206,890 troy ounces of which but 7 percent or 14,593 ounces were iridium, rhodium, osmium and ruthenium. Imports of ruthenium, alone, in 1940 amounted to 1,448 ounces.

The principal use of ruthenium is as a hardener for other platinum metals, although one of its salts also serves as a biological stain.

A recent War Production Board order, which prohibits the use of iridium and rhodium in the manufacture of jewelry, has brought a wider demand and utilization of ruthenium in that field.

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Rutile

AN ORE associated with granite, limestone and dolomite, rutile is the commercial source—with ilmenite—of titanium. In fact, the ore is titanium dioxide, containing in theory about 60 percent titanium. It occurs in crystalline form, sometimes with traces of iron, and occasionally in massive form.

It has a hardness of 6 to 6.5 and a specific gravity of about 4.2. The color is reddish-brown and it has a brilliant metallic luster. Marketing is in the form of concentrates. (See Titanium dioxide).

In 1940, imports of rutile declined to 156

short tons valued at $14,849 against 442 tons valued at $23,170 in 1939. However, probably several times this quantity of rutile was imported from Australia in the form of mixed concentrates classified as "zirconium ores".

Domestic production of rutile in Arkansas and Virginia — and lately in other States, notably New York, is undoubtedly reaching new all-time highs, although the figures cannot be published.

Rutile, as such, is used to the extent of two to three thousand tons per year for coating welding rods for the electric arc. The fluxing power of the titanium dioxide gives a slag of the right viscosity and its electrical properties aid in producing a steady arc.

Rutile imports have been placed under strict government control; while use of titanium pigments has been restricted under WPB's Order M-44, issued Nov. 21, 1941. The Order stated "The total output of titanium pigments industry being at present insufficient to meet the total of defense needs and existing civilian demand, due to the lack of sufficient production of titanium dioxide for use as pigment, * * *".

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Rye

RYE occupies a minor place among the cereal crops of the United States, being overshadowed by the size and importance of corn, wheat and oats. The nations bordering on the Baltic Sea in Europe produce the bulk of the world's rye crop of approximately two billion bushels. In northern Europe soil and climate are better suited for rye than for wheat production, and rye is used largely as a bread grain. Russia is the largest producer and consumer, followed by Germany and Poland. Due to the abundance of wheat in the United States, there is but little demand for rye as a bread grain. Our total domestic rye needs, including milling and processing, are amply filled by a crop of forty-five millions of bushels annually.

Farm livestock shows preference to other cereals over rye, which is particularly unpalatable to poultry. The two branches of consumption open to wheat, i.e., bread and feed for livestock, are both limited in the case of rye.

Satisfactory yields of rye can be produced on soils too thin, or in climates too rigorous for wheat. Winter rye can be grown successfully under climate conditions where winter wheat fails. While over half of the United States rye crop is grown in four states, North and South Dakota, Minnesota, and Nebraska, the greater portion is produced in areas of those states which are lower than average in fertility.

The rye plant is used also for late fall, winter and early spring pasture for livestock. Under such conditions the harvest of grain is of secondary importance. The whole plant is also used as a green manure to improve soils impoverished in fertility.

Under normal conditions, the rye crop of the United States, plus carry-over, is sufficient for domestic needs, and some small surplus available for export.

The principal use of rye is in the production of human food. Although wheat has generally displaced rye in the human diet, rye bread is still an important staple. Rye is similar to wheat in composition and its protein is of a nature that permits the use of yeast in the making of raised bread.

The by-products of milling, such as rye middlings, rye bran, and rye feed are used as feed for livestock.

Rye is also used for distilling purposes and large portions of the American and Canadian crops go into whiskey.

The whole rye wafer is gaining some popularity in this country. It plays an important part in reducing diets.

Official standards of quality, or grade, are established and supervised by the United

States Department of Agriculture, and are known as "United States Standard Grades." Five grades are recognized: No's. 1, 2, 3, 4 and sample. Sample grade includes all rye which does not meet the requirements of any grade from 1 to 4. In addition, the special grades, or designations, of "tough," "smutty," "garlicky," or "weevily" are added when conditions warrant.

The marketing unit is a bushel. Transportation by truck, rail and boat is the same as for other grains. The main substitutes for rye are wheat, corn and other feed grains and, in some instances, potatoes. The import duty is 12 cents per bushel.

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Rye Whiskey

See Distilled Spirits

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Saffron

SAFFRON is the dried stigma of Crocus sativus L.; cultivated principally in Spain and Portugal. Its principal use is in flavoring and coloring of foods. Marketing is in one pound tins—priced at $40.00 per pound as of June 6th, 1942. They come as general cargo and sometimes by parcel post. The quality, under good care, is stable for several years. The best saffron contains a minimum percentage of yellow stigma. Safflower (obtainable from Mexico) and Annatto are substitutes. There is no duty imposed by the United States.

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Sage

THIS herb (Salvia officinalis) is used primarily as a flavoring in the manufacture of sausages, stuffing of fowl, etc. Its leaves are grayish-green, pungent and aromatic. It also has astringent and mild tonic value. The principal grade is Dalmation which is grown in Yugoslavia and shipped to this country in compressed bales of 440 lbs. each. The two types are Stemless (Garden) and Grinding. The duty is 1 cent per lb. The war made this herb extremely scarce. Other sage growths are found in Greece and Spain and in various states of this country but none can be classified as the equal of the Dalmation sage as defined by the U.S.P.

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Sage Oil

SAGE, or salvia oil is a yellowish or greenish- yellow oil obtained by the distillation of the leaves of Salvia officinalis. Dalmatia is the most important center of sage oil production, although Spain produces a sage oil of relatively poor quality. A clary sage oil, distilled from the flowers or entire herb of Salvia Sclarea is also of commercial importance. Clary sage grows natively in Southern France, Italy, and Northern Africa, and is now also cultivated in Germany and Holland.

Sage is among the spice materials being suggested as suited for cultivation in this country. It is pointed out that many gardens in America contain some sage and it will only be necessary to increase the acreage to supply the entire market. Commercial cultivation is already practiced in Massachusetts, New Hampshire, and Vermont. Experimental cultivation is going on in Virginia and California. Imports of sage into the United States in normal times is approximately 1,500,000 pounds with a value of $50,000.

Sage oil is employed mainly in flavors. Commercially it is packed in 25-pound tins. The price of the Spanish sage oil on June 1, 1942 was $3.50 per pound. Around January 1, 1942 the price was $2.15. At the start of 1941, it was $3.50 per pound.

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Sal Ammoniac

See Ammonium Chloride

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Sal Soda

See Soda Ash

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Salicylic Acid

SALICYLIC ACID is produced either as colorless crystals, usually in fine needles, or as a fluffy, white, crystalline powder. It is synthesized from Phenol, naturally in areas of Phenol production but principally in the States of New Jersey, Missouri and Michigan. The principal uses and finished products are: medicinals, dyes, intermediates, preservatives, aromatics, Aspirin, Methyl Salicylate, Sodium Salicylate, minor Salicylates. The marketing unit is in 100 lb. and 150 lb. wooden barrels, moving both by truck and rail. Prices have remained unchanged for some time at 35¢ per lb. for the USP grade which is for medicinal use; and 33¢ per pound for the "technical" grade for industrial use and manufacturing purposes. It will keep indefinitely. The United States duty is 7¢ per pound on the "technical" grade, plus 40 percent ad valorem; and 7¢, plus 45%, on the USP quality.

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Salmon

ONE of the most important and certainly one of the most widely known and appreciated species of fish is the salmon.

Best known is the canned salmon. Salmon are also sold as fresh and frozen, both whole, eviscerated; as steaks, and as mild cured. By the far the greatest amount of the total production goes into canned salmon.

The world pack of canned salmon for 1940 amounted to 8,777,084 full cases. Of this amount Alaska produced 5,028,378 cases; Puget Sound, 121,428 cases; Columbia River, 386,999 cases; U. S. Coast streams, 12,097 cases; British Columbia, 1,445,101 cases; Siberia and Japan, 1,783,-081 cases.

The varieties of salmon used for canning, are: King, Spring or Chinook; Red, Sockeye or Blueback; Pink, Silver, Coho or Medium Red or Chum and limited amounts of Steelhead Trout.

The only fishes that may be properly termed salmon are the species of Pacific salmon named above, of the genus Oncorhynchus and the certain large members of the trout family, genus Dalmo. The Atlantic and European salmon are seldom canned.

Of the world's salmon pack the pink are in the most abundance. The pack of pinks was 4,203,838 cases. Next comes the Red, Sockeye or Blueback, with 2,019,977 cases. Chum or Keta had 1,553,389 cases; Medium Red, Coho, Silver had 678,952 cases; King or Chinook had 286,485 cases and Steelhead Trout had 34,443 cases.

The total canned salmon packs have shown a steady decline since the high point of 1936, the 1940 pack being 4,380,056 cases below that figure and almost a million cases below the relatively low pack of 1939. The shortage is in the pack of reds and pinks, the other species being ahead of last year. Alaska was ahead of last year in all species except the reds and kings. Both Puget Sound and the Columbia River made the smallest packs in years.

The greatest Salmon producing area is Alaska which, in 1940 produced 953,381 cases of Reds, to lead the world in this specie; 2,908,025 cases of Pinks, again leading the world pack; 860,539 cases of Chum, again world leadership; 284,130 cases of Medium Reds, leading the world by a small margin here and dropping to 22,303 cases of Kings and no pack of Steelhead Trout.

The total United States pack of salmon for

1940 was 5,548,902 cases and for 1939, 5,971,527 cases. The world pack of canned salmon for 1939 amounted to 9,728,806 cases.

Pacific salmon grades are: heads on, eviscerated, Chinook or King, No. 1, large red, 14 lbs. and over; small red, not over 26 inches and up to 14 lbs.; white, 26 inches and up; Silver, No. 1, no size limits. No. 2 grades are the same size and weights as No. 1 but are bruised, scarred or show signs of softening.

In general, there is no attempt to grade salmon except according to species. On the Columbia River, Chinooks are segregated into various grades according to color, oil, etc.

Tin containers are mostly in sizes from one pound tall, one pound flat, ½ pound flats (8 oz.), ¼ lb. flats, 1 lb. and ½ lb. ovals, to 4 lb. cans.

Size of the cases vary with the size of the cans. For example, quarters would be 16 dozen to a case; four pound cans, twelve to a case and so on. They are mostly packed in corrugated shipping containers although wooden cases are also used extensively.

Due to the war, Alaska cannery operations have been badly curtailed due to lack of boats and close proximity of war conditions. The same conditions, but to a lesser degree, apply to other areas. Government protection and aid is being and will be given in increasing amounts and ways, for the need for the salmon pack is great. A big drop can be expected this year however, with much of the pack going to the armed forces and Lend-Lease.

The same price ceiling restrictions placed on all canned goods extends to salmon.

Fishing seasons vary with the localities and types of fish. Reds are caught mostly in June-July for Alaska; mid-July to early September further south. Alaska Pinks are caught between mid-July and August, while Puget Sound Pinks are caught from mid-August to September. Chums are caught in the Fall; Silvers have a long season, reaching a peak in late summer and early fall. May to September is the period for Chinooks.

Salmon are caught with pound-nets, purse seiners, gill-nets and hook and line trollers.

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Salt

SODIUM CHLORIDE (NaCl), a crystalline compound, colorless or white, better known as salt, is found abundantly in solid and solution form. It is a stable compound containing about 60 per cent chlorine and 40 percent sodium but, as "common" salt usually also has traces of harmless impurities such as calcium sulfate, and calcium and magnesium chlorides.

Salt deposits are found in crystalline masses, known as rock salt or mineral salt. Furthermore, inasmuch as it is easily soluble in water, salt is found in all waters. Sea water usually contains about 3 percent and fresh water a trace of salt. The specific gravity is 2.1 to 2.6, its hardness 2.5—between gypsum and calcite—and the melting point is 1479.2° F. In making brines, 100 parts of water will dissolve about 36 parts of salt.

Salt production in the United States has been continually reaching new high points. In 1941, 12,720,629 short tons were sold or used by producers—3,330,106 tons as evaporated salt (manufactured); 6,771,436 tons "in brine"; and 2,619,087 tons as rock salt. These sales were valued at $33,620,376 or an average of $2.64 per ton. In addition, 11,605 tons were imported and 87,807 tons exported. The national output was 23 per cent higher than in 1940.

Michigan, New York and Ohio, in the northeastern section of the country, supply about 67 percent of all salt sold or used by producers. New York leads in the production of rock salt; Michigan in the production of

evaporated salt. Louisiana and Kansas, in the south central section, are the next largest producers with California leading in the western states.

Increasing demands to meet both civilian needs and the requirements of the war production program have necessitated the production of larger amounts of essential chemicals from common salt. While the United States has plenty of salt the facilities for converting the basic material into chemicals has been a problem. The result has been a serious shortage of chlorine, for making high-octane gasoline, for producing brighter cleaner-looking paper, in laundries and other clothes-cleaning processes, etc. Textiles processes also use large quantities of chlorine and it is an important product for water purification and sewage treatment.

Sodium, chlorine's twin in common salt, also has many uses, most of which have expanded. It is a basic material for heavy chemicals. Demands on these chemicals, especially soda ash, have been increasing. One of the large uses for soda ash is in glass which has replaced tin and other metals in many fields.

Normally, about half the production of salt is employed in the form of brine for the production of chemicals and the other half is marketed as dry salt. As dry salt it finds its principal use in livestock feeding and food preparation, including canning, preserving and in the manufacture of flour and similar articles. Salt is evaporated by several methods—in open pans or grainers, in vacuum pans, and by the sun. Both sodium and chlorine are indispensable to animal life and common salt meets this requirement most readily. Pressed blocks weighing 50 to 60 pounds, sometimes smaller, are sold for livestock.

The War Production Board, as early as Dec. 20, 1941 restricted the use of chlorine.

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Salt Glaze

See Glazed Brick and Tile

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Saltpeter

See Sodium Nitrate

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Sand

SILT, SAND AND GRAVEL all result from the disintegration of rocks, only varying as to size of the grain particles. They are distinct from clay which contains organic matter. Sand consists of particles of less than 2 millimeters in diameter while at less than 1/16 millimeters the particles form silt. Standard sand is a silica sand, often above 98 per cent silica, free of organic matter and able to pass through a 20-mesh sieve but not a 30-mesh. Sands, of course, often contain such other minerals as feldspar, garnet, monazite, zircon, etc.

It is important to differentiate between the "sand and gravel" and "industrial sands" industries. The latter industry, as a matter of fact, is more in the nature of a non-metallic mineral, or chemical, industry.

Silicon dioxide, or silica, is probably the most important industrial mineral, an essential constituent in a vast number of manufactured products, and a contributing factor in the production of many others.

There is virtually no branch of American industry which is not dependent to one degree or another upon the uses of silica.

The extensive use of silica is the result of the unusual combination of physical and chemical properties. When properly prepared, it is one of the most inert of all substances, highly resistant to the action of acids and the weather, able successfully to withstand high temperatures, and is inherently hard, durable, and uniform.

For glass-making, silica sands free-of-iron are used. Usually the sand employed com-

mercially is obtained from river-beds or from sand dunes. Although much of the earth's surface is sandy, the variety of highest commercial importance is that which has been separated from organic matter and by activity of water or wind and accumulated into particles of very near uniform size. Production of sand and gravel reached a new peak in 1941—the culmination of a steady rise since 1933, only interrupted in 1938. Naturally, use of sand varies with construction activity—building and paving. In 1941, a total of 85,170,510 tons of sand valued at $56,342,321 was sold or used by United States producers. Of this total, 40 million went to building, 27 million to paving, 7 million to molding, and above 3 million for glass. In addition, 18,665,000 tons of sand were government, States, counties, and municipalities' sand—about one third for building and two-thirds for paving.

New York, California, Illinois, Ohio, Michigan and Pennsylvania are the leading producers. In 1939, there were more than 2,000 commercial sand and gravel plants in the United States, more than half of them small — having an annual production of less than 25,000 tons. Before 1926, the quantities of sand and gravel used were approximately equal but during recent years the quantity of gravel used has expanded faster than that of sand, principally because of the growing demand for aggregates to satisfy the expanded highway construction program. Molding sands have shown the more important quantity increase among the industrial sands, chiefly due to the automobile industry.

The average value per ton of sand reported by commercial producers is characteristically much higher than that of government-and-contractor operations, the difference being explainable in terms of cost of washing, screening, or other preparation.

Although sand is sold by the cubic yard or ton, it is always priced on a weight basis. The weight will vary from 2,600 to 3,100 pounds per cubic yard depending on the composition and the size of the particles.

The average price of "noncommercial" sand sold in 1941 for building and paving averaged 31c. By classes, 1941 averages for various types of "commercial" sands were: glass, $1.76; molding, $1.16; building, 54c; paving, 55c; grinding and polishing, $1.39; fire and furnace, $1.10; engine, 65c; filter, $1.23; and railroad ballast, 27c.

INDUSTRIAL SANDS

Glass sand. Production of glass sand in 1941 increased 26 percent in quantity and decreased 0.6 percent in average value, with a tonnage of 3,475,000 short tons valued at $6,114,000 compared with 2,760,000 tons at $4,882,000 in 1940. Average value per ton was $1.76 in 1941 and $1.77 in 1940. Leading producing States in order named were Illinois, West Virginia, Pennsylvania, New Jersey, and Ohio.

Molding sand. Increasing 45 percent in output and 11 percent in average value, production of molding sand was 7,246,000 short tons valued at $8,413,000 compared with 5,005,000 tons at $5,269,000 in 1940. Average value per ton increased to $1.16 from $1.05 in 1940. States leading in production of molding sand were Michigan, New Jersey, Illinois, Ohio, and New York.

Grinding and polishing sand. Increasing 17 percent in tonnage and 30 percent in average value, 1,002,000 short tons of grinding and polishing sand valued at $1,389,000 were produced in 1941 compared with 856,000 tons at $916,000 in 1940. Average value increased to $1.39 from $1.07 a ton in 1940. Pennsylvania, Michigan, Illinois, New Jersey, and Missouri were the leading producing States.

Fire or furnace sand. Production of fire or furnace sand increased 20 percent in tonnage and decreased 8 percent in average value in 1941, with an output of 326,000

short tons valued at $357,000 compared with 271,000 tons at $326,000 produced in 1940. Average value decreased to $1.10 from $1.20 per ton in 1940. States leading in production were Indiana, Illinois, Pennsylvania, and New Jersey.

Engine sand. Production of engine sand in 1941 was 2,023,000 short tons valued at $1,312,000, an increase of 24 percent in tonnage but with no change in average value. Production in 1940 was 1,635,000 tons at $1,070,000. Leading producing States were Pennsylvania, West Virginia, Nebraska, Indiana, and Illinois.

Filter sand. Production of filter sand in 1941 was 264,000 short tons valued at $324,000 compared with 119,000 tons at $164,000 produced in 1940, an increase of 123 percent in quantity and a decrease of 11 percent in average value. Average value dropped to $1.23 from $1.38 in 1940. North Carolina, New Jersey, South Carolina, New York, and Ohio led in production.

Other sand. Sand produced for miscellaneous purposes increased 5 percent in tonnage and decreased 5 percent in average value in 1941, the output being 2,023,000 short tons valued at $1,455,000 compared with 1,923,000 tons at $1,470,000 in 1940. Average value dropped to 72 cents a ton from 76 cents in 1940. This sand was reported as used for icy sidewalks, stock car bedding, pottery wares, silicate of soda, coal preparation, filler, fertilizer, golf courses, and childrens' play boxes.

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Sand Pine

See Southern Pine

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Sandalwood Oil

SANDALWOOD OIL is a yellow liquid obtained by steam distillation from Santalum album. The most important source of the oil is the wood grown in the state of Mysore in British India. A certain amount of the wood is also harvested in the neighboring states of Madras and Coorg; in the Dutch East Indies, particularly Timor; and in Australia. In addition to its value as a source of oil, sandalwood is esteemed as a carving material, and its chips and dust are used as incense.

Mysore controls its sandalwood as a strict monopoly. Every tree grown in the state is accounted for, and can only be felled with the government's permission and as proscribed by the forestry department. Mysore annually produces an average of 2,000 tons of sandalwood, the bulk of which is used for distillation in the government factory, while 10 to 12 percent is sold and mostly exported for carving and incense purposes. Previous to World War I practically all sandalwood oil was produced in Europe and America from the Indian wood. However, when the war stopped ocean commerce, and stocks of the wood accumulated in Mysore, the government constructed a distilling plant and has made it a great success. Production has steadily gained, until at the present the average annual output of the oil is about 100 tons. This amounts to about 87 percent of India's total production and includes oil distilled in New York from wood imported from Mysore under special arrangement, in order to avoid the 12.5 percent duty on the imported oil.

The producing states around Mysore do not control their wood or oil production with the same diligence, and therefore still offer American and European distillers a source for the wood. Imports of sandalwood into the United States during 1939 were 583,000 pounds, with British India supplying 581,000 pounds. Domestic producers, anticipating commercial disruption perhaps, imported almost 1,000,000 pounds of the wood during the first nine months of 1941. The yield

of oil from the wood is approximately five percent.

Imports of sandalwood oil into the United States in 1940 totaled 5,449 pounds, valued at $15,774. British India was responsible for 3,700 pounds, and Australia for 1,120 pounds. In 1939 imports of the oil amounted to 8,622 pounds valued at $29,798. In that year British India shipped 4,520 pounds to this country, and Australia 3,304 pounds. The oil was shipped in tin cans containing 25 pounds net weight.

Sandalwood oil is widely employed in perfumes, cosmetics, and soaps, and is a well known medicinal item. The price of domestically distilled oil on June 1, 1942 was $6.90 per pound, while the imported oil cost $7.00. At the start of the year, the domestic oil was $5.85, and the imported oil $6.00. One year earlier, the prices were $4.95 and $5.00 per pound respectively.

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Sandarac

SANDARAC is a natural resin produced by tapping the tree, Tetraclinis Articulata, native to northern Africa. It is white and brittle in appearance and is sometimes known as White Gum or Australian Pine gum because it resembles the resin from an Australian tree, Callitris arenosa. It is soluble in turpentine and alcohol, melts at 135°C. It comes mostly from Algeria and Morocco. Its principal uses are in lacquers, and in a spirit varnish—hard and white—for coating paper and finishing wood and metal. Shipments to the United States are by boat from Mogador in Morocco, in casks of about 300 pounds each. Prices have fluctuated very widely since 1940, because of the war. It is not perishable. The grade used in the United States is more or less a standard type in the form of small chips. There is no substitute, and no duty imposed on Sandarac.

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Sap Gum

See Hardwoods

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Sapphire

See Corundum

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Sardines

THE war focused increased attention on the American sardine. Not only were former popular Norwegian, Swedish, Portuguese and other European imported products entirely shut off by the war, but American sardines were shipped to Europe in ever-increasing quantities, under the Lend-Lease, to replace shortages there.

There are two packs of sardines—the Maine, or East Coast sardine and the Pilchard, or West Coast sardine. Considerable controversy exists between the two as to which is the true sardine—the Maine product being the herring and the West Coast being the pilchard (member of the herring family).

During 1940, 27 canneries in Maine packed 1,117,748 standard cases, amounting to 27,943,700 pounds with a value of $3,736,394. During 1939, a record year, 26 canneries packed 2,155,433 cases, amounting to 53,885,825 pounds with a value of $6,911,579. The drop in 1940 was due to scarcity of herring suitable for packing (small herring). The season opened a month earlier in 1942 and indications were that the pack would come close to the 1939 record. The government took over the entire 1942 season's pack but the trade reports that part of the pack would be released for home consumption.

Most of the Maine pack is normally handled through the various food brokers and the large chain store or food store buyers. The pack is mostly in the regulation key type sardine flat can. The Maine production season is early summer to late fall.

The West Coast pilchard pack is even more important from the point of volume and value of the production. Unlike Maine, the pilchard is used not only for sardines but it is also packed as fillets, and large quantities are also turned into fish meal and highly valuable oils.

The greatest amount of pilchards are caught with the purse siene. In Maine some herring is seined but the bulk is caught in weirs or traps.

Pilchards are caught near the canning centers off the California coast. They are caught mostly on moonless nights when fishermen can detect the large schools by the phosphorescent glow on the waters made by the schools. Prime fish of canning sizes are segregated for that purpose; others go to the reduction plants for oil and meal.

The majority of the California sardines are packed in 1-lb. oval cans. Five ounce to 1-lb. tall cans are also packed. Sardine fillets are packed in 1-lb. square tins.

Some pilchard are taken for the fresh fish markets, for bait and for quarter-oils. These figures are not available and not included in other figures given here. Some pilchard have been made into canned pet food but actual figures are not given here—this product is now prohibited under the general tin conservation law.

Price ceilings are for all processed fish and therefor apply to pilchard, and Maine sardines as well.

California in the 1941-42 season, August-March, produced 583,463 tons; cases of 1-lb. ovals, 2,181,634; cases of other size cans packed, 3,087,588; other size cans reduced to equivalent cases of 1-lb. ovals, 2,973,480; meal, tons, 85,103; oil, gallons, 16,498,965.

The 1940-41 season production in California amounted to 454,709 tons; cases of 1-lb. ovals, 1,463,699; cases of other sizes packed, 1,729,704; other size cans reduced to equivalent cases of 1-lb. ovals, 1,652,767; meal, tons, 71,122; oil, gallons, 12,398,310.

During 1941 there were approximately 74 canning and reduction plants in operation in California. The bulk of these were located in the San Francisco district. Others are located at Monterey, San Pedro and San Diego districts.

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Sassafras Oil

SASSAFRAS OIL is a yellow liquid distilled from the root of Sassafras officinale. The tree is found throughout the Eastern portion of the United States from the St. Lawrence to Florida, and west to Kansas. Production is chiefly by small operators, who locate their stills in the sassafras regions. In recent years the distilling has moved toward the south and become more scientific as to equipment and procedure. A certain amount of production is still carried on in Pennsylvania. Domestic requirements of the oil are satisfied internally.

An artificial sassafras oil is also an article of commerce. In 1940, imports of the artificial oil amounted to 521,625 pounds, valued at $172,377. The 1939 imports totaled 867,398 pounds, valued at $221,964. Japan supplied the entire quantity in each of the periods shown. Commercially the natural oil is packaged in drums of about 500 pounds and tins of 50 pounds. The artificial oil is packed in drums of approximately 400 pounds, and 50-pound tins.

The largest use of sassafras (natural) is in the soft drink field. The artificial is generally used for soap and other industrial deodorizing purposes. The price of the natural oil on June 1, 1942 was $1.80 per pound. On January 1, 1942 the price was $1.10, and a year earlier $1.05 per pound.

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Sassafrasy

See Camphor Oil

Sauerkraut

SAUERKRAUT is the product of characteristic acid flavor, obtained by the full fermentation, chiefly lactic, of prepared and shredded cabbage in the presence of not less than 2% or more than 3% of salt. Upon completion of the fermentation, it contains not less than 1.5% of acid, expressed as lactic acid. Sauerkraut which has been rebrined in the process of canning or repacking contains not less than 1% of acid, expressed as lactic acid.

Production continuity starts with the delivery of the cabbage to the kraut plant by the grower. After it is cleaned and shredded, it is conveyed to wooden tanks where it is salted and packed. Heavy weights are placed on the wooden covers to keep the contents compact. Subject to temperature, it will ferment. When the test shows 1.5% lactic acid, it is ready for consumption. Average annual domestic production is around 500,000 forty-five gallon barrels or 5,000,000 cases of No. 2½ tin cans, packed 24 tins to a case. During the winter, while in bulk form, it remains quite normal but is perishable in summer.

Federal Grade "A" is termed "Fancy Kraut" and Grade "C" is termed "Standard." The tin shortage induced by the war prompted the government desire that the only canning of the Fall, 1942, season, would be for the Armed Forces and allied agencies. This was expected to seriously curtail normal consumption because of storage difficulties for the bulk product in the summer.

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Scheelite

See Tungsten

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Scotch Whiskey

See Distilled Spirits

Scrap Iron and Steel

SCRAP IRON and steel is one of the important raw materials for the steel industry, total consumption by that industry last year amounting to 45,635,000 net tons. Of that total, the steel industry itself supplied approximately 27,894,000 tons in the form of scrap produced in its own operations. The remaining 17,741,000 tons were purchased by the steel industry from outside sources. Scrap consumption in 1941 was at record-breaking level — in both the "purchased" and "home" categories.

Maximum scrap prices have been established by the OPA, the prices varying with the grade of scrap and consuming point. A composite price of scrap steel, as computed by one of the trade papers, has stood at $19.17 a gross ton for over a year.

There are a number of different grades of scrap officially recognized with prices established for each of these. Among the principal grades of scrap are: basic open hearth grades which have several subdivisions, blast furnace grades also subdivided and electric furnace, acid open hearth and foundry grades, in each of which there are several different classifications. Descriptions of these grades appear regularly in trade papers. (See Iron and Steel)

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Scrap Steel

See Scrap Iron and Steel

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Scrod

See Haddock

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Sealskins

See Fishskins

Seaweed

See Kelp

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Secondary Prophyl Alcohol

See Isopropyl Alcohol

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Selenium

A NON-METALLIC element (Se), selenium chemically is related to and resembles both tellurium and sulphur. It is produced as a byproduct of copper mining. Like sulphur, it occurs in various allotropic forms. A brick-red powder is amorphous selenium; while vitreous selenium is a brownish-black, brittle glassy mass. The specific gravity of the element is 4.8 and the melting point about 215° C. It burns in air with bluish flame. Because of its sensitivity to electrical resistance, and the fact that its conductivity changes with the degree of light, it is used in various photo-electric devices.

Consumption of selenium in glassmaking has been by far the leading use. Here it acts as a decolorizer, and permits the production of pure red and ruby glass. It is also employed to improve the machinability of copper and copper alloys and additions have been made successfully to steels, where the addition has had the effect of sulphur addition without the deleterious effect of sulphur on corrosion resistance and mechanical strength. Selenium rectifiers have been employed recently in several industries.

In 1940, the United States production of selenium rose to 328,731 pounds against 227,131 pounds in 1939 while 134,429 pounds valued at $198,163 were imported.

Selenium (black-powdered, 99.5 percent) was priced at $1.75 per pound in mid-1942 while barium selenite ($BaSeO_3$) was quoted at $1.40 to $1.60 a pound. "Commercial" (25 percent Se) was priced at 85¢ per pound and sodium selenite at $1.50 to $1.65 per pound.

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Serpentine

See Asbestos

★ ★ ★

Shale

See China Clay

★ ★ ★

Shark Liver Oil

See Fish Liver Oils

★ ★ ★

Sharkskins

See Fishskins

★ ★ ★

Shearlings

See Sheepskins

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Sheep

SHEEP raising dates back to ancient times, supplying man with food and clothing for thousands of years. In all probability, sheep have been kept by man longer than any other class of domestic livestock. It still remains an important industry in many parts of the world.

Sheep raising in the United States developed slowly until about 1840; then westward migration carried it to rapid expansion, facilitated by the building of highways and railroads. By 1848 small amounts of wool were exported to England. However, sheep raising in the older states began to decline and was replaced by dairying.

After the close of the Civil War and the passage of the Homestead Law, sheep raising began a second era of expansion, aided

by the demand for muttons in the mining camps of the far west. The fertile and gently rolling acres of the central west were made into farms and corn, cattle, hogs and sheep were raised. The building of railroads to the west made possible the shipping of wool to the east and sheep raising began to expand in the Plains states. The development of dryland agriculture forced the sheep into the mountain ranges. The United States sheep population increased about 60 percent from 1872 to 1884—from about 32,000,000 to a shade over 50,000,000. This caused an overexpansion of the ranges and a temporary price decline.

Today the development of transportation and of the packing house industry have made the Plains and mountain areas important sources of lambs for slaughter and for further fattening on corn belt farms. Sheep raising in the corn belt area is mostly for slaughter, with wool a by-product. Sheep and wool still continue to be an important product of the hilly sections of the Ohio valley.

The sheep population fluctuates in accordance with a number of factors such as the markets for lamb and wool, operating costs and weather conditions. The number of sheep on farms Jan. 1 1942 (including sheep and lambs on feed for market) amounted to 55,979,000 head or the largest on record. Under the national production goal for 1942, about 51.2 million sheep were to be shorn compared with 48.9 million in 1941. Plans were made for the slaughter of 22.9 million sheep and lambs compared with 22.6 million in 1941.

The leading sheep producing states are Texas, California, Wyoming, Montana, Utah, New Mexico and Ohio. Important world producing nations are Australia, the United States, Russia, Argentina, Union of South Africa, New Zealand, British India and Spain.

The principal uses for sheep are in the production of wool for clothing and slaughter for food. Shearing usually starts in February and March and extends through July. Most sheep are shorn only once a year but some in Texas and California are shorn twice a year. Shearing in Australia extends from July through November. In Argentina, shearing is heaviest from October through December.

There are generally two periods of heavy lamb marketing. During May and June, native lambs weaned fat are shipped, and in August, September and October range lambs appear.

Sheep and lambs are sold by the hundredweight. Prices in Chicago early in June, 1942 were as follows:

Spring lambs, good and choice—$14.50 @ $15.25.

Spring lambs, medium to good—$12.75 @ $14.25.

Shorn lambs, good and choice—$13.00 @ $13.75.

Shorn lambs, medium to good—$11.50 @ $12.75.

Shorn ewes, good to choice—$5.50 @ $6.50.

The duty on sheep and lambs is $3 each.

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Sheepskins

SHEEPSKINS and lambskins are the skins from any variety of wool sheep. The United States ranks third in importance as a sheep raising country but is first in production of sheep and lambskins, first in imports, and the largest consumer of these skins in the world. Ranking next in order below the United States as sheepskin producers are Australia, India, New Zealand, the United Kingdom, and Argentina. The largest exporter of sheepskins is India, which ships nearly 15 million skins annually under normal conditions. Australia is a close second in volume of imports. The United Kingdom is the second largest consumer of sheepskins.

The value of sheepskins varies considerably, and not all sheepskins are of commercial value. The value of sheepskins, like that of all other types of hides and skins, is determined by their leather making value. There is often a considerable waste in sheepskin production due to poor flaying and improper curing. At the same time, some sheep do not have a skin well adapted to leather making and in general the skins of heavy wooled sheep have skins that are too thin, porous, and inclined to ribbiness. Only the cheapest leather can be made from these skins and the market value is so low as to discourage careful production.

About half of the sheep and lambskins are tanned in the United States, with New Zealand supplying nearly half of the imports.

Sheepskin leathers share with goatskin leathers an antiquity far beyond that of other types of leathers. They are frequently mentioned by the ancient writers and, in the time of the Grecian power, sheep leathers were used as blankets, and for making garments, sandals, and numerous other articles.

Sheep and lambskin leathers are tanned by the same processes (vegetable, chrome, or alum) and are used for much the same purposes. Small skins with a fairly fine grain are classed as lambskins by the leather trade, while the larger and coarser grained skins are known as sheepskins.

Pickled sheepskins (cured in a salt brine liquor and shipped in casks) from Australia, New Zealand, and South America are superior for leather making to the skins of domestic animals. There are many varieties of wool sheep, each having its own inherent characteristic length and texture of wool as well as thickness and texture of hide fibre. Besides the wool sheep, there are two types of hair sheep, the skins of which are important to the leather industry—a Brazilian sheep known as the cabretta, and a South African sheep from which the glove leather known as Capeskin is tanned.

Sheepskins are used for making leather for shoe linings, slippers, shoe uppers, sportswear, garments, gloves, fancy leathers, bookbinders, leather, roller leather, and a number of special leathers. They are also used for making chamois leather, which is the oil tanned under split of sheepskins, suede finished.

Sheepskins with the wool left on are known as shearlings and have an important commercial value. They are skins which have been sheared shortly before slaughter and the short remaining wool is left on the skin when tanned. They are used chiefly for clothing, for some types of house slippers, and for some types of shoe trimmings. A recently developed method of finishing shearling sheepskins with an electrical process transforms the wool to a hair-like texture. These skins are used extensively in the manufacture of slippers and have also become an important fur for making women's medium price coats and jackets.

All shearlings are of special importance in war production and are required in large quantities for making aviators' clothing and special clothing for Arctic wear. Because of this, the entire production and supply of all shearlings was placed under Government control in Dec., 1941, and at the present time only such skins as have been rejected by the Government as unfit for military purposes are available for civilian use.

The price of shearlings is also controlled by an Office of Price Administration order which sets specific prices of $2.15 for No. 1 packer shearlings; $1.90 for No. 2s; $1.00 for No. 3s; and 40¢ for No. 4s. The prices set by the OPA schedule are generally conceded to be slightly high in comparison with the ceilings on other types of raw stock, but this was done to provide a production stimulus.

Pickled sheepskins, the skin part of a wool pelt with the wool removed, were placed under price ceilings in May, 1942. This

price order resulted in individual ceilings for each seller, figured on a base price. The ceiling includes both domestic and imported pickled sheepskins.

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Shellac

See Plastics

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Short Leaf Pine

See Southern Pine

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Shrimp

BY FAR the most important seafood of the Gulf area is shrimp. Hundreds of shrimp draggers and thousands of fishermen are engaged in this fishery as well as large, modern, thoroughly up-to-date canneries employing thousands of workers.

During 1940 the production of shrimp amounted to 152,663,000 pounds with a value of $5,954,000. Of this amount the South Atlantic and the Gulf accounted for 150,541,000 pounds with a value of $5,893,000. The Pacific area had 1,138,000 pounds valued at $19,000. Alaska had 921,000 pounds valued at $37,000. The Mississippi River and Tributaries had 49,000 pounds valued at $4,000. New England had 9,000 pounds valued at less than $500 and the Middle Atlantic had 5,000 pounds valued at $1,000.

During 1939, production was 150,250,000 pounds, valued at $4,913,000, indicating a nice gain in both production and values for 1940. It is expected that 1941 will also show a gain over 1940 but not expected is a gain in 1942 over 1941. There seems to be a growing shortage of shrimp as intensive fishing is beginning to have its affect.

Efforts to develop a big shrimp fishery off Maine, where large beds of shrimp exist, proved somewhat of a failure. The shrimp were smaller than the southern shrimp and much harder to secure in abundance. The cost of production and canning proved excessive.

There are no price ceilings on fresh shrimp but there are on the frozen and canned products. Considerable quantities are moved to the market as fresh and frozen shrimp, heads removed. These travel by refrigerator cars, trucks and express. China was once a big market for dried shrimp but the war has changed that.

Production figures rose, a few years back, when large shrimp beds were discovered miles off-shore. Larger boats were built and Diesels were introduced in the southern shrimp boats for the first time. Off-shore shrimp are large, called "Jumbo" shrimp and are sold mostly as fresh and frozen, headless.

During 1940, 48 canneries turned out 989,946 standard cases of shrimp, amounting to 16,743,737 pounds with a value of $4,318,325. Standard cases here means the various sizes converted into 48 five ounce cans to the case, for purposes of this table. During 1939, there were 1,215,019 cases valued at $5,354,086, quite a drop from the 1940 total.

The 1940 pack, divided into the various sizes, amounted to: (Dry Pack) 19,745 cases of 48 four ounce tins; 131,596 cases of 48 five ounce tins; (Wet Pack) 936 cases in 48 four ounce tins; 813,028 cases in 48 five and three-quarter ounce tins; 1,391 cases in 24 nine and three-quarter ounce tins; 9,163 in 12 thirty-two ounce tins; (glass, wet) 1,848 cases in 48 two and one-half ounce jars; 497 cases of 24 four ounce jars; 18,454 cases of 24 five and three-quarter ounce jars; 8,085 cases of 24 six ounce jars.

Quick frozen packaged shrimp have made their appearance, but not in any great commercial quantities as yet.

The shrimp, Penaeus setiferus (Linnaeus), is abundant in the Gulf of Mexico. The South Atlantic is the only other big source of

shrimp production. However, related species are taken on the West Coast and in Alaska. The common shrimp makes up 95% of the catches. Two other species figure only in a small way. The firm meat of the tail, or abdomen, is the only part eaten. The head and the thorax, which also contains the vital organs, are removed before cooking, shipping or canning. The body is pale green or light gray and rather transparent. Like most shellfish, shrimp turn red after cooking.

The female shrimp produces approximately 500,000 eggs and lays these eggs directly into the water. The young shrimp move into the inside waters where they are caught in abundance in the bays, sounds, rivers and bayous throughout the spring and summer. During June, July and August, the shrimp, that have survived, move into larger bodies of water. They are of commercial size when they attain a size of about four inches. By September practically the entire fishery is composed of shrimp hatched from the spawning of the previous spring and summer. No two-year shrimp have ever been found so it is assumed that they die after the first year.

Like other shellfish the shrimp wears its skeleton on the outside of its body and, in order to grow, must cast off this shell and replace it with a newer and larger one. The time between molts is a comparatively short one.

The common shrimp swims in a forward direction by the use of the pleopods or abdominal feet. It can also propel itself backward and even jump out of the water.

Shrimp, sold in the market, run as high as 70 shrimp to the pound, headless, both fresh and frozen. There is always a good demand for shrimp the year around and particularly in the warm weather when salads are in vogue. All shrimp, canned, fresh or frozen, are cooked shortly after being landed.

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Silk

The war with Japan, principal normal source of supply for raw silk, practically put an end to the use of silk for civilian purposes. On Feb. 10, 1942, all supplies in the United States were taken over by the Defense Supplies Corp. and reserved for military uses.

The possibility of creating a silk industry in Latin America became a subject of much study and research. Brazil is the only Latin American nation producing silk at the present time but sericulture (production of raw silk by raising silkworms) in that nation is still in its infancy. Any silk or silk waste imported from Brazil would probably be reserved for war purposes. Accordingly, no commercial production from there need be looked for until the end of the war.

The following analysis of the raw silk industry is therefore largely academic, applying as it does to conditions as they existed prior to the war.

The scientifically bred silkworm which produces the high quality of raw silk necessary for use in American silks is an extremely delicate insect which thrives only under certain climatic conditions and whose food is restricted exclusively to leaves of the mulberry tree. Until Pasteur discovered a cure for the notorious silk-worm disease, which created such ravages in France near the middle of the 19th century, silkworm breeding remained too hazardous a business to be practiced commercially on a large scale. Since that time, however, the science of rearing the silkworm has made great strides, particularly in Japan, where climatic conditions are especially suitable to both the silkworm and the mulberry tree. Sericulture, or silkworm growing, is still the subject of a great deal of intensive scientific research.

The insect that makes the silk is the larva of the small moth called Sericaria Mora

but more commonly known as the silkworm. The silk moth exists in four states—egg, larva, chrysalis and adult. When the egg is hatched in the early Spring, the young worm is fed on leaves of the white mulberry. The worms are kept on trays for convenience. After attaining full growth, in about six weeks, the worm spins its cocoon. The silk issues from an opening below the worm's mouth. It comes out in a glutinous state and apparently in a single thread. The worm works incessantly, forcing the silk out by the contraction of its body. For three days this spinning of the cocoon continues. The cocoon is tough, strong and compact, composed of a firm, continuous thread.

After the cocoon is finished, the worm's skin breaks and is crowded back off the body, revealing the chrysalis, an oval cone one inch in length. Since the emergence of the moth will break many threads and ruin the cocoon for reeling, all those cocoons not intended for seed are placed in a steam heater to stifle the chrysalis, and the silk may then be reeled at any future time. The life span of the female moth is two to three days. One moth lays from three to four hundred eggs, depositing them over an even surface. It takes from 2,500 to 3,000 cocoons to make a pound of reeled silk.

When ready, the cocoons are sold in the open market to reelers. Silk reeled by hand or foot power is known as "Re-reel" silk, while silk reeled by power machinery is called "Filature."

Reeling consists of unwinding the single filament of each cocoon and in the same operation combining the filaments of several cocoons into a single continuous raw silk fibre.

The unreeling of the cocoon requires trained operators and here Japan's export position was helped prior to the war by the low price of Japanese labor; unreeling costs would have been prohibitive at Western wage rates even if the essentially favourable Japanese climatic conditions could be duplicated.

Most Japanese silk is reeled in machine equipped factories. There are more hand reeling filatures than machine reeled, but their output is far less.

The greatest single quality required of the silk fibre for weaving is evenness. This requires great skill on the part of the reeler, because each thread has a varying diameter —thinner at the beginning and end than in the middle. Furthermore, the raw silk fibre proper is composed of several cocoon filaments which are attached to the reeling machinery, twisted and reeled together in one continuous filament. The reeling operator must exercise great care to see that the individual filaments remain unbroken and that the required number of cocoon filaments is used in each stage of the reeling operation to produce a fibre of constant diameter. The raw silk thread is no thicker than a human hair and may itself be composed of as many as six or seven individual cocoon threads.

There are two major silk cocoon crops in Japan, the Spring crop and the Summer/Autumn crop.

Prior to the war, Japan was the largest producing nation of the world, accounting for about 78 percent of total world output. China ranked second, followed by Italy, Caucasia, Turkestan and Persia. World production in 1940 amounted to 962,637 picul bales.

The leading pre-war use of silk was in the manufacture of hosiery; between 75 and 85 percent of U. S. imports were thus used. Next in importance was production of woven goods and there were also several minor uses. Silk was used by surgeons to tie arteries and sew together cuts and it was also used in dental work. Miscellaneous uses included the winding of fishing rods and the use of the silk snell for fishing hooks.

Among the important war uses are the production of parachute cloth and flare cloths.

The marketing unit for raw silk is the pound. During the 1939-40 season, prices in New York averaged slightly more than $3.00 per lb. It is generally packed into picul bales, weighing approximately 132¼ lbs. each.

Raw silk is graded in two broad classes, according to the weight of the fibre, which is to say, the weight in deniers of a certain stipulated length of raw silk. A "denier" was an old French coin, the weight of which is still used as a standard for numerous purposes in France. The 13/15 denier silk was used mainly in the manufacture of hosiery, while 20/22 denier silk was used both for knit goods and for woven materials.

Raw silk of both weights is graded on the basis of evenness and cleanness, which in turn are registered in percentage as compared with perfection. Very little raw silk of less than 73% general evenness was commercially used. By far the major portion rated between 78% and 90%. Cleanness requirements were mostly for 80 to 90% and higher.

Even before the war, silk was beginning to feel the competition of substitutes. Rayon was the most important competitor and nylon appeared in the hosiery field. Cotton and other textiles have also moved into some of the fields formerly occupied by silk.

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Silk, Noils

A RESIDUE from the manufacture of spun silk; produced mostly at spun silk mills located in Rhode Island, Massachusetts, Connecticut and New York. It is used mostly for spinning yarn for cartridge cloth for the making of powder bags. It is priced by the pound with a 75¢ quotation for April, 1942, against 60¢ per pound a year earlier. It is mostly transported by truck, in bales of about 450 pounds. Principal types are "long" and "short." There are no substitutes reported by the trade at present. The United States does not impose a duty on imports.

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Silver

SILVER is one of the oldest known metals. It is classed as a precious metal and for years has been widely used for coinage and for making silverware and jewelry. In recent years industrial uses have been developed which indicate wide future uses in the industrial field.

It is mined mostly in the Western Hemisphere. The largest producer is Mexico, followed by United States, South America and Canada. The total production in 1941 was 203,500,000 troy ounces.

Aside from monetary uses, silver is used principally in fabricated form for making jewelry and silverware. Its industrial uses include uses as silver brazing alloys which have grown very rapidly in recent years. It is used in electrical contacts and in making chemical equipment where corrosion is an important factor. Silver brazing alloys, formerly used so widely in making refrigerators, automobiles, air conditioning systems, electrical equipment, etc. are now used in enormous quantities in the building of ships, tanks, guns, airplanes, shells and ammunition. The use of silver in the photographic industry is also a very large one. Another job this metal is doing is the replacement of nickel, chrome, copper and cadmium by silver plating. It is also widely used as a reflecting surface and backing for mirrors.

Silver is marketed usually in 1,000 troy ounce bars. The price in the world markets is issued daily by Handy & Harman and is known as the New York Official price. The

price at present is $35\frac{1}{8}$¢ per troy ounce. Transportation is usually by Express.

Silver is one of civilization's most unperishable products. It lasts through the ages under normal atmospheric conditions. It is also highly resistant to a great many types of corrosion.

Pure silver is known as Fine Silver and commercial bars are usually 999 Fine. It is made into many alloys with base metals. Sterling Silver, for example, is $92\frac{1}{2}\%$ silver and $7\frac{1}{2}\%$ copper; coin silver is 90% silver and 10% copper. Other base metals commonly used with it are zinc, nickel and cadmium.

Silver and Sterling Silver have a color all their own. Although attempts to copy their exclusive color have been many, nothing as yet has been discovered to give its whiteness or warmth in appearance.

There is no duty on silver.

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Silver Lead

See Graphite

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Sisal

See Hennequen

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Skipjack

See Tuna

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Slash Pine

See Southern Pine

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Slate

CLAYS and shales which have been converted into a finely grained rock by compression, with a characteristic slaty cleavage, are the commercial slates used by American industry. Slate is quarried in large blocks and then slabbed and split to size. The coloring varies with the composition, being black, gray, green and even reddish.

Imports of slate have always been insignificant while exports during normal times have been valued at close to $200,000, mostly slate granules and flour.

Slate has met competition from many other materials. Thus, sales, a good indicator of production, have been reduced for most uses in recent years. Principal slate-producing states are Pennsylvania, Virginia, New York and Maine.

There are really two classifications of slate sales and production, "dimension slate" and, granules and flour. For the most part, slate used for the manufacture of granules is unsuited for other slate products.

Sales of dimension slate in 1940 totaled 154,450 short tons, of which 347,130 "squares" were roofing slate, 440,080 square feet electrical slate, 784,160 sq. feet structural and sanitary slate, 251,070 grave vaults and covers, 1,023,250 blackboards and bulletin tops, 243,700 billiard-table tops, 413,680 school slates, and 1,380,040 square feet flagstones — including walkways, stepping stones, and miscellaneous slate. Production of granules and flour totaled 319,000 tons. Since 1929 slate has followed closely the trend of total building construction but is still far short of the peak activity of 1925.

Slate granules are used extensively in surfacing prepared roofing and slate flour is employed as a filler in paints, road asphalt-surface mixtures, roofing mastic, oilcloth, linoleum and various other products. In 1940, 230,440 tons of granules were sold at a value of $2,009,151 while flour sales were 88,560 tons valued at $292,750.

Electrical slate is the principal product of Maine quarries; while New York-Vermont produce the attractive green, purple, mottled and red roofing slates. Pennsylvania pro-

duces an abundance of slate varieties, including the blue-black roofing slate while Virginia has a small production of the blue-black variety.

Roofing slates vary in thickness from 1/8 to 3/4 inch and in size range generally from 6 by 12 to 14 by 24 inches. The average weight of slate is usually 175 pounds per cubic foot.

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Slunk

See Calfskins

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Snakeskin Leathers

See Reptile Skins

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Soapstone

SOAPSTONE, called also steatite, is a massive variety of impure talc. While it is easy to cut, it becomes extremely hard through loss of water when heated.

Statistically, talc, pyrophyllite and ground soapstone, are combined. (See talc, pyrophyllite.)

Five industries—paint, ceramics, roofing, paper and rubber—use seventy-five per cent of these products as produced domestically.

Medium hard varieties of soapstone are used for building trim and for table tops or sinks while the hard varieties are utilized for stair treads and sometimes for flooring. The waste product when cutting soapstone is ground and used in the same fashion as talc powder. Virginia produces a gray-green soapstone which is weather-resistant and useful in the building trade. Albarene, another Virginia soapstone, is blue-gray in color.

Imports of soapstone, talc, steatite and French chalk have dropped off with the war. In 1940, most of the crude and unground material came from China and the Union of South Africa and the cut and sawed varieties from Italy and Japan. Ground talc, steatite or soapstone, and French chalk came from seven countries with Italy the leading source, followed by France, Canada, Br. India, Japan and Egypt. United States has long been the leading producer of these materials and there need be no fears of a war-shortage.

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Soda Ash

SODA ASH is the term commonly applied in commerce to the anhydrous powdered form of sodium carbonate. It is also known as calcined soda. When containing 10 molecules of water of crystalization (decahydrate) it is known as sal soda or washing soda. A material containing one molecule of water of crystalization is also encountered as soda monohydrate. Commercial soda ash itself is usually a grayish white lumpy or powdered material containing at least 99 percent of sodium carbonate.

The famed Le Blanc process was first used to produce soda ash. Sodium chloride (salt) and sulphuric acid were reacted to form sodium sulphate, which in turn was reduced to produce soda sulphide. The sulphide was then reacted with calcium carbonate (limestone) to make sodium carbonate. The Le Blanc process however also produced considerable amounts of byproducts and has been superseded by the Solvay or ammonia-soda process.

In the Solvay method, a solution of common salt is first saturated with ammonia gas, and then carbon dioxide is bubbled through it. The carbonic acid formed reacts with the ammonia to produce ammonium bicarbonate, which immediately reacts with the sodium chloride (salt) to give sodium bicarbonate. The latter precipitates and is filtered out, dried, and heated to produce the anhydrous soda carbonate. The carbon dioxide formed

as a byproduct in the final heating is re-used in the process, while the ammonium chloride formed earlier reacts with lime from another earlier step to liberate ammonia for reuse. Only small amounts of calcium chloride constitute waste product; a certain portion of this is recovered and sold, the remainder disposed of.

Production of soda ash by the ammonia-soda process in 1939 amounted to 2,013,264 tons, valued at $31,115,153. Ten plants produced the material during the year. In 1937, the output of nine plants totaled 2,205,-006 tons, valued at $32,306,416. In addition, a small amount of soda ash obtained from natural deposits or produced in the electrolytic manufacture of caustic soda is also marketed. In 1939 such sources furnish 132,897 tons, valued at $1,755,863; and in 1937 they supplied 118,753 tons, valued at $1,462,354

Commercially, soda ash is usually identified as "58 percent" material, which indicates that it contains an equivalent of 58 percent of sodium oxide. This percentage corresponds to 99 percent of anhydrous sodium carbonate. It is offered in dense, light, and extra light grades, the former being higher in price because of extra processing involved. The hydrated forms are also higher in price because of additional processing needed in their production. The monohydrate usually contains an equivalent of 85.6 percent of soda ash, and the decahydrate only 37.1 percent.

Dense soda ash is packed in boxes weighing 25, 100, or 275 pound bags containing 300 pounds; and barrels holding 450 or 500 pounds. Light grades of soda ash are sold in 25-pound boxes; 100-pound kegs; 200 and 300-pound bags; and barrels containing 300 pounds. Both forms are also often shipped in bulk, in carload quantities.

Soda ash enjoys a greater commercial tonnage as regards consumption than any other sodium compound. It is an inexpensive alkalizing or neutralizing agent and therefore enters a multitude of processing fields. Its principal use, however, is in the glass industry, where it enters to the batch. The second largest consumer is said to be the chemical industry, which employs it for its alkaline qualities and in the manufacture of sodium compounds. Other important uses of soda ash are in the manufacture and as a builder in soaps and soap powders; as an ingredient of cleansing and detergent preparations; in the production of paper and pulp; in the processing of textile fibers; and in water softening. Light grades of soda ash were quoted at $1.05 per 100 pounds, in bags, on June 1, 1942. This price had been in effect for some time. The dense grade was quoted at $1.15 per 100 pounds on June 1, 1942; and at $1.10 per 100 pounds on January 1, 1941.

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Soda Lye

See Caustic Soda

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Soda Monohydrate

See Soda Ash

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Soda Spar

See Feldspar

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Sodium Benzoate

SODIUM BENZOATE, or benzoate of soda is widely known through its use in foodstuffs as a preservative by the prevention of bacterial growth. This is the major use of the material. Physically, sodium benzoate is a white, amorphous, crystalline, or granular odorless powder having a sweetish, astringent taste. It is easily soluble in both hot and cold water and moderately soluble in alcohol. Commercially, sodium benzo-

ate is made by neutralizing benzoic acid with sodium bicarbonate and crystallizing.

The production of sodium benzoate in 1939, the only year for which official figures are available, amounted to 1,608,318 pounds, valued at $500,877. Six plants contributed to this total. Packaging of benzoate of soda commercially is in 250 and 100-pound barrels; 50, 25, and 5-pound boxes; 5 and one-pound bottles; and one-pound cartons.

Purity of the United States Pharmacopeial grade of sodium benzoate must be at least 99 per cent, calculated on a dry basis. A technical material, almost meeting these specifications, is also sold. The use of benzoate of soda as a preservative in foodstuffs must be declared on the labels of the foodstuff container. Usually 0.1 per cent is used for such preservation, and the acidity of the foodstuff regulated to produce the most effective preservation. The price of soda benzoate on June 1, 1942 was approximately 40¢ per pound for the technical material and 46¢ per pound for the U.S.P. grade. These quotations have been in effect for the past two years.

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Sodium Bichromate

See Bichromates

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Sodium Bromide

SODIUM BROMIDE is the most important of the bromides in commerce. It is a white crystalline powder or granular material, with a salty, somewhat bitter taste. Since it absorbs moisture from the air upon standing, it must be stored in well-stoppered or sealed containers. Industrially, sodium bromide is produced by dissolving ferroso-ferric bromide in water, adding sodium carbonate, filtering the solution and then evaporating the salt to dryness.

Production of sodium bromide in 1939, by four manufacturing plants, amounted to 1,343,992 pounds, valued at $281,654. Commercially, it is packed in 500-pound barrels; 100 and 25-pound fiber drums; 100, 50, and 25-pound boxes or canisters; and 5 and one-pound bottles. The United States Pharmacopeial grade, most common in the trade, is 99 per cent pure.

The principal uses of sodium bromide are in photographic emulsions and medicine. The U.S.P. material for the past several years has been quoted at 27¢ per pound in large quantities.

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Sodium Hydrate

See Caustic Soda

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Sodium Nitrate

NATURAL sodium nitrate is used chiefly as a fertilizer to supply nitrogen to the soil. It is used by itself or mixed with other compounds which supply phosphorus and potassium. Industrial requirements (including the manufacture of munitions) are supplied principally by the synthetic product. Natural sodium nitrate was the principal raw material in the manufacture of nitric acid for explosives and other uses before the large-scale development of the synthetic ammonia industry. It is also called soda niter and Chile saltpeter. There is no important source other than Chile, although in the general field of nitrogen compounds, besides synthetic ammonia, other sources of supply are synthetic calcium cyanamid and by-product ammonia obtained in the manufacture of coke.

The composition of sodium nitrate is $NaNO_3$; it is usually a massive granular chrystalline structure with a hardness of 1.5 to 2 and a specific gravity of 2.29. It is colorless to white, sometimes colored by impurities and readily soluble in water. Synthetic Chile saltpeter is made by the fixation of nitrogen and is marketed granulated, in

crystals, or in sticks. It is colorless, odorless, and has a melting point of 316°C. For many years the nitrate industry in Chile was developed jointly by the Government and foreign capital but in 1933 it was made a State monopoly. Due to increased competition from synthetics, Chile's production in recent years has fallen rather sharply. The total of 1.6 million short tons in 1939 was only 45 per cent of the 1929 output.

The United States is the best market for Chilean nitrates. In 1937, we took 574,000 long tons, or 40% of total exports. Natural sodium nitrate enters the U. S. from Chile free of duty. Imports from Chile have, for a long time, been handled by a single agency in New York, which is also in charge of distribution. In pre-war years, Europe usually took about 50 percent of the exports. While the U. S. production of the synthetic product has risen from 24 percent of domestic use in 1914 to 62 percent in 1929, to 75 percent in 1935—it is likely that this country's demands will continue to absorb a large part of the Chilean output. The Defense Supplies Corporation, in January, 1941, contracted for 300,000 tons. The price early in 1942 was about $20.00 per ton f.o.b. Chile but freight rates and war risk insurance have increased the landed price in the United States.

The War Production Board by Order M-62, effective Jan. 15, 1942 prohibited delivery of sodium nitrate, defined as commercial material containing up to 16.47% nitrogen from whatever source, except as may be specifically directed by the Director of Priorities. Such directions will be primarily to provide an adequate supply for essential civilian uses as for agricultural purposes, meat processing and preservation, industrial nitric acid, potassium nitrate and industrial explosives for Government projects, mining (metallic and non-metallic), quarrying, petroleum exploration and development, production of forest products, railroad and highway construction and agriculture. For such uses, deliveries may be made without limitation—subject to provisions made each month by the Director of Priorities, and Priorities Regulation No. 1.

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Sodium Salicylate

SODIUM SALICYLATE is encountered in commerce as lustrous, white powder or crystalline flakes, having a sweetish, yet saline taste. It is very soluble in water, and also soluble in alcohol and glycerine. Production is by heating sodium phenolate with carbon dioxide under pressure. In some foreign countries, sodium salicylate is used as a foodstuffs preservative in much the same manner as sodium benzoate, although more expensive. Such use in the United States is prohibited, even if stated on the label.

In 1940, three plants in the United States manufactured 734,123 pounds of sodium salicylate. Sales in that year were 684,702 pounds, valued at $289,803. In 1939, production by a similar number of plants totaled 497,423; with a value of $195,180. Commercially, sodium salicylate is packed in 200-pound barrels; cases containing 112 or 224 pounds; 100-pound kegs and fiber drums; 50, 25, and 5-pound boxes, and one-pound bottles and tins.

Chief use of sodium salicylate in this country is in medicine. The price of U.S.P. sodium salicylate in recent years has been about 52¢ per pound.

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Soluble Dried Blood

THIS blood is collected from slaughtered animals at packing houses and defibrinated preparatory to drying in drying alleys or spray dryers. Total domestic annual production has been about 5,000,000 lbs.

Principal uses are: (1) An adhesive for

fir plywood construction; (2) An adhesive for hard plywood construction; (3) A stabilizer for asphalt emulsion; (4) a clarifier for tanning extracts; (5) An emulsifying and wetting agent and adhesive for insecticide sprays and dust.

Marketing is in paper-lined burlap or cotton bags for carload and LCL shipments. The latest carload price is $13\frac{1}{2}$ cents delivered.

The product remains stable for about one year under normal storage conditions. After that, insolubility may occur and tend to increase progressively.

Substitutes are resin, casein, animal glue, and soybeans.

The duty is 6¢ a pound.

The war resulted in practically 95 percent of the output in this country going into essential war production. Strict control was exercised over its distribution and practically no material was available for ordinary civilian consumption.

The product plays an important part in extending phenolic and urea resins, thereby freeing a certain amount of phenol for lend-lease shipments or essential war use.

The expanded use of hot-pressing technique has widened the potential domestic consumption of soluble dried blood which requires an application of heat for plywood bonding.

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Sorgo Syrup

An edible, sweet syrup competing with cane syrups and molasses, sorgo syrup is pressed from the sorgo, or sweet sorghum, of which many varieties are found in all parts of the world. The syrup contains considerably more invert sugars than cane syrup and also some starch, dextrin, etc.

Many years ago, there were those who believed that the sorghum would supply the sugar needs of the United States, but its cultivation for the extraction of syrup has dwindled constantly over recent years. However, a revival has taken place on a small scale recently due to the shortage of cane sugar.

Most of the sorghum production of the United States is centered in the lower Mississippi Valley states. In Louisiana, planters are devoting acreage to its production, for conversion into industrial alcohol, as an experiment under the encouragement of the U. S. government. A good part of the production is in crude fashion by planters who use it for home consumption.

In 1942, it is estimated that 11,681,000 gallons of sorgo syrup will be made in the United States against 11,267,000 gallons in 1941 and 15,870,000 gallons in 1934. In 1940, Alabama was the leading producer, followed by Texas, Mississippi, Arkansas, and Tennessee. Kentucky, Georgia and North Carolina were also well up on the list. The average yield per acre has held almost constant at about 60 gallons while the farm value per gallon for a seven-year period 1934-1940 ranged from 50.6 to 58.0¢. A gallon of sorgo syrup weighs approximately 11.4 pounds and contains the equivalent of about 7 pounds of sugar.

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Southern Pine

For over a century the forests of southern (U.S.) pine have been supplying large quantities of lumber and allied products for a multitude of purposes. The southern-pine lumber industry has been an outstanding factor in the rapid development of the United States; in fact, much of the unprecedented construction which marked the turn of the century was accomplished with southern pine.

The production of this lumber has been and continues to be greater than that of any other single American wood. Production of yellow pine in 1940 totaled 10,162,966 (thousand feet board measure) and repre-

sented 35 percent of the total wood cut. Alabama was the leading state with 1,560,879 thousand board feet; Georgia was second with 1,454,631 thousand board feet, while Arkansas, Mississippi, North Carolina and Texas each reported above one million "thousand board feet."

Southern pine is frequently called "yellow pine" because of the yellowish color of the wood but is often referred to as "hard pine" because its wood has a greater strength than other coniferous wood for the purpose for which it is adapted.

Although there are nine species of southern pine growing in an extensive area comprising 19 States, or portions of them, only four of the species are recognized as of chief commercial importance because of their plentiful supply, inherent properties, and adaptability to a wide variety of uses. These are the longleaf, shortleaf, loblolly and the slash pines.

The longleaf pine, a beautiful, stately, forest tree grows in a belt about 150 miles wide extending along the Atlantic Coast from Virginia to Florida and westward along the Gulf Coast into Texas. The largest stands are in the States bordering on the Gulf of Mexico. The wood of the long-leaf pine is heavy, hard and resinous, ranging in color from a uniform reddish yellow to a reddish brown. A large part of the log produces heartwood lumber, inasmuch as the sapwood is thin. Growth rings, usually narrow, are uniform in width and outline, running from 8 rings per inch to 12, or more.

Shortleaf pine, east of the Mississippi, grows over an extensive area in pure stands, mixed with loblolly or scattered among hardwoods. West of the Mississippi, it frequently forms large forests on the tablelands of the hill country, especially in Arkansas, northern Louisiana, and southern Missouri. Altogether shortleaf pine grows in all of the nineteen states comprising the range of the southern pine country. The wood of shortleaf pine is of medium hardness and weight and is moderately resinous. The color ranges from whitish brown to reddish brown while the sapwood is variable but usually rather thick. Growth rings are mostly of medium width and usually average from six to eight per inch.

Loblolly pine grows along the Atlantic Coast and the Gulf of Mexico in a belt about 200 miles wide extending from New Jersey to Texas. This species is frequently referred to as "old-field" pine, as it is quite common in old, abandoned fields. Few, if any, other trees show such persistence in encroaching upon and occupying abandoned fields and open spaces. Over large areas of the Mississippi, loblolly forms extensive pure stands, where the trees attain large size and develop a good form. While loblolly grows faster than either shortleaf or longleaf pines, it does not develop as fast as slash pine during the first 20 years; after that, however, loblolly apparently exceeds all the other southern pines in rate of growth. The wood varies from hard and compact to light, coarse and brashy. In color, it ranges from yellowish to red or reddish brown. The sapwood is quite thick while growth rings are usually extremely broad, running from four to six rings to the inch.

Slash pine has a somewhat more limited range of growth than the other three varieties mentioned, extending from the southern part of South Carolina westward through Georgia, Alabama, Mississippi, and southeastern Louisiana, and southward through Florida. Slash pine is distinctly a tree of the coastal area, seldom being found more than 100 miles inland. In recent years it has spread over much of the land formerly dominated by longleaf pine. It requires a wet soil for its best growth and thrives on poorly drained flats near bays and swamps, although it does grow on sandy ridges that often border such areas. Trees of this species grow very rapidly, especially when young. The general prop-

erties of the wood of slash pine and that of longleaf pine are almost identical.

Five species of southern-pine which are of minor economic importance are pond pine, spruce pine, sand pine, Virginia pine and pitch pine.

The perpetuation of timber supplies is of especial importance to all of the people in the extensive area within which southern pine grows and such steps as improved fire protection, better forest practices and more complete utilization are of prime importance. Many southern pine manufacturers have been leaving seed trees standing on logged areas and doing what they can to prevent injury to seedlings and young trees as well as seeding and planting in cut-over areas. However, the pressing needs brought about by the war are believed to have produced a drain which gravely exceeds the growth.

Many of the southern-pine mills represent the ultimate in equipment and technique (from the logging camp through the sawmill, dry kiln, and planing mill), so that their lumber products are precisely manufactured, seasoned and graded.

After the lumber is cut in the mill, possibly no other factor will so greatly increase its usefulness as proper seasoning. Practically all southern pine, with the exception of timbers, is carefully seasoned by the air-drying method or through the use of kilns. When lumber is properly seasoned, it "stays put" in construction because the moisture content of the lumber has been approximately stabilized with atmospheric conditions.

Air drying usually takes from 60 to 90 days and correct stacking is of extreme importance for proper air circulation. Modern kiln drying is more rapid and—in addition to reduction in weight and complete control of moisture content, — stain or decay fungi or insects, that may have infected the wood, are killed. Standard grades have been adopted covering moisture content (kiln-dried dimension stocks must not exceed 15 percent) and stains. Sometimes, in air-dried lumber, an antistain solution is used.

The strength of wood is closely related to its weight or density. At 12-percent moisture content, longleaf pine weighs 41 pounds per cubic foot; shortleaf 36 pounds, and loblolly 36 pounds. Southern pine is heavier than most woods used for structural purposes. Woods of high density provide superior construction strength and "density" standards, adopted by the American Society for Testing Materials, have been embodied in the grades of the Southern Pine Association. Regulations require that there be at least six annual growth rings per inch of wood and that the summerwood must occupy one-third of the cross section, measured in a specified manner. Pieces having less than six annual rings per inch meet the standards for density if the summerwood is one-half of the cross section.

Hardness is the property that enables resistance to wear and crushing under loads. Southern pine qualifies in this respect, as exemplified by its wide use for decking on wharves, for flooring in factories, for railroad ties, etc. The hardness also permits a polished finish, and is also a factor in the power to hold nails, bolts or screws. Resistance to decay is marked in the heartwood of southern pine and its resinous properties have been found especially resistant to attack by insects, such as termites. The "weathering" property of southern pine is only fair but when painted it is highly suited for bridge, trestle and dock construction. Southern pine is generally referred to as a "hard-textured" wood, although certain varieties definitely fall into the "soft-textured" grouping.

Southern pine will glue satisfactorily and readily takes shellac, varnish, or seal finish—and, with reasonable care and by use of recommended practices, will hold paint satisfactorily.

In recent years, exports of southern pine

have been reported to upwards of 70 foreign countries. The construction of the Panama Canal required millions of feet of southern-pine lumber and today large quantities go into the maintenance of this great waterway.

From early colonial times, southern-pine forests have been the single source of the tremendous quantities of turpentine and rosin. And, in recent years, southern pine has supplied more and more of the country's pulpwood. The kraft industry has grown by leaps and bounds and commercial news-print operations are in progress. It is understood that over 25 percent of the country's consumption of pulpwood now stems from southern pine.

Maximum prices for southern pine were first fixed by the OPA on August 16, 1941. Subsequent orders and amendments followed and on July 14, 1942 the Order M-19 was completely revised. The new order covers literally hundreds of different specifications, lengths, standards and varieties—too numerous to catalogue here. For example, maximum prices for Shortleaf Yellow pine lumber f.o.b. mill per one thousand feet board measure "Finish S4S, kiln dried Short Leaf" B and Better grade, 1 x 2 and 3, "Standard length" are $62.00; 8 foot length $59.00; 10 foot length $62.00; 12 foot length $62.00; etc.

Limitation on the sales, shipments or delivery of "softwood" "construction lumber" were embodied in the War Production Order L-121 made effective on May 13, 1942. Grade No. 1, 2 and "C" of Southern Pine come under this order in certain specifications.

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Soybean Oil

SOYBEAN OIL is one of the two major products obtained from the processing of soybeans. The other is soybean cake, also known as "meal." There are three different milling processes for the conversion of the soybeans. The "old process" or pressure methods are hydraulic and expeller methods. The new method gets the oil out by a solvent.

As a general statement, about 8½ pounds or slightly more than a gallon of oil, and 45 to 50 pounds of meal, are obtained from each bushel of beans.

During recent years there has been a phenomenal expansion in soybean oil output. Production in the 1941-42 season was estimated at about 736 million pounds. The production goal set up by the U. S. Department of Agriculture for 1942-43 called for 9 million acres of harvested beans with an estimated output of 1,125 million pounds of soybean oil.

Soybean oil has a very wide variety of uses. It has developed rapidly into one of the leading competitors in the edible oil market. In shortenings, cooking oils and oleomargarine manufacture it competes directly with cottonseed oil, though its use in oleomargarine dates back only to 1936.

The oil has been the basis for many spectacular laboratory metamorphoses. It goes into printing ink. It is used in waterproof goods, linoleums, varnishes, enamels, paints, soaps, and glycerine.

The National Soybean Processors Association has set specifications for the crude soybean oil. These are:

	Maximum	Minimum
*Iodine Number (Wijs)		130
Unsaponifiable Matter	1.5%	
Free Fatty Acids	1.5%	
Moisture and Volatile Matter @ 105 C. (Allowance if over 0.2%)	0.3%	
Break (Modified Gardner Method)	0.60%	

Soybean oil with a low free fatty acid, low refining loss, and good flavor and color when

* This specification applies only to high iodine value grade oil when stated in the original contract.

carefully refined, is best for edible products. Soybean oil, cottonseed oil, peanut, olive, sesame, and corn oils, all have approximately the same shortening value.

Oil with an iodine number from 131 to 143 is suitable for paints. It has the property of mitigating the after yellowing of white paint. It produces a lustrous, elastic film with weather-resisting properties.

Soybean oil is well suited to soft soaps, though in the hard soaps it is necessary to hydrogenate it to replace some of the hard fat usually supplied by various inedible animal falts. It is best for the so-called automobile and hospital soaps, where it replaces linseed or corn oil.

American customs have curtailed the use of soybean oil in the edible oil field, but its use has grown rapidly nevertheless.

At the present time, soybean oil cannot compete successfully with linseed oil in varnish, lacquer, and enamel formulæ. The raw oil produces a mushy film. If, however, the oil is properly oxidized or polymerized, it takes a limited place in the drying oil field.

Soybean oil has valuable film properties which make it useful for linoleum, oilcloth, and waterproof fabric industries, when used in combination with other drying oils.

The oil now being produced is vastly superior, as a result of prolonged laboratory work, to the original domestic production.

The National Soybean Processors Association has set up trading rules and quality standards now generally complied with.

Chemically speaking, the original soybean contains from 34 to 37% of protein. Soybean protein contains principally gylcinin—a globulin type of protein. Practically 90% of the fatty acids are unsaturated. Average iodine number of domestic soybean oil is about 130. The fatty acids of soybean oil differ from corn oil and cottonseed oil chiefly in that they contain linolenic acid and less palmitic acid. In composition soybean oil lies between the food oils of corn and cottonseed and the drying oil linseed.

Under rules of the National Soybean Processors Association, standard quality crude domestic soybean oil break is determined by a specified "Modified Gardner Method." "Quick shipment" is within 3 working days, "immediate shipment" within 5 working days, and "prompt shipment" within 10 working days. In the handling of soybean oil meal "if a name descriptive of the process of manufacture, such as expeller, screw presses, hydraulic, or extracted be used, the product must correspond thereto." All controversies are subject to arbitration pursuant to rules of the American Arbitration Association of New York.

Crude soybean oil is marketed in tank cars. The price in June, 1942, was 11¾¢ per lb., Decatur basis—the established ceiling price. Refined oil is sold in drums. The price in June, 1942, was 15 to 15½¢ per lb. The duty is 20%.

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Soybeans

SOYBEANS are grown in the United States virtually wherever corn is grown. Production has increased enormously in recent years, partly as a result of increasing demand for soybean oil and soybean oil meal. The drought resistance quality of the soybean has allowed farmers to plant it after other crops have been irreparably damaged by lack of moisture. Its relative immunity to insect infestation has also contributed to its popularity as a crop. In fact, so rapid has been the expansion in production that an entirely disproportionate share of the annual crop has been diverted from consumption channels to go back into the ground as seed.

The leading producing states are Illinois, Iowa, Indiana and Ohio. Production in 1941 amounted to the record total of 106.7 million bushels and 1942 estimates were for an even

higher total. However, we are still far behind China and Manchuria, which lead the countries of the world in production.

Soybeans themselves, without milling, have only limited usage. A few varieties are grown and picked green for use as a vegetable. A small amount of whole beans are fermented and processed into soy sauce. In the Orient considerable quantities of soybeans are ground wet and curdled to form soybean curd or vegetable cheese. This product has not yet proved very acceptable in America.

From these facts, it is evident that the soybean milling industry is directly responsible for the phenomenal increase in soybean production. Beans have been grown in America since 1804, but they were of no commercial importance until the first successful soybean milling enterprise was established in Illinois in 1922.

The two principal products resulting from the milling operation are soybean oil meal, and soybean oil.

More than 95% of all soybean oil meal produced is used for feeding livestock and poultry. The balance is used for fertilizers, glues, plastics, etc. The feeding of livestock does not lend itself to dramatization and human interest stories, and therefore many people are led to believe that the minor uses of soybean oil meal are the major uses.

Extensive laboratory work is in progress for the development of new uses for soybean oil meal, soybean oil, and whole soybeans and undoubtedly many new fields will be developed.

Considerable progress is being made in developing uses for soyflour in various products for human consumption.

Soyflour is a high protein, high fat pleasant almond tasting flour which is finding considerable favor in bakery products, macaroni, pancake flours, malted drinks, infant foods, breakfast foods, and diabetic foods. It appears that soyflour is on the threshold of a greatly expanding market in the food industry. . . .

The marketing unit is the bushel weighing 60 lbs. The price at Chicago in the spring of 1942 approximated $1.75 per bushel. The government established a base price of $1.60 per bushel on the farm for high-oil content varieties. This was to apply to the 1942-43 crop. The duty is 2¢ a lb.

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Spar

See Feldspar

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Spearmint Oil

SPEARMINT OIL is a colorless to pale yellow oil distilled from the fresh aboveground portion of Mentha spicata. The United States Pharmacopeia specifies that it contain at least 50 percent of carvone. Spearmint is much like peppermint as regards cultivation. Exports of Spearmint oil in 1939 totaled 37,742 pounds, valued at $74,942. Commercially the oil is packed in 60-pound cases and 20-pound tins.

Spearmint oil is used mostly in the flavoring of chewing gum and confections. Its price on June 1, 1942 was $3.10 per pound and on January 1, 1942, $3.25 per pound. At the start of 1941 it was priced at $2.50 per pound.

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Spelter

See Zinc

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Spermaceti

SPERMACETI is also known as cetaceum, and is a pearly-white wax-like substance obtained from the sperm oil found in the head of the whale. It is almost odorless and taste-

less and becomes rancid on exposure. In purification, the crude material is filtered under pressure to remove stearin, then boiled with water alkalized with a small amount of caustic soda, and then thoroughly washed. Technical and a United States Pharmacopeia grade of spermaceti are offered commercially. They are packed in cases containing 50 or 60 pounds.

Imports of spermaceti in 1939 amounted to 179,741 pounds, valued at $22,828. The United Kingdom supplied 173,741 pounds of this quantity, and Japan 6,000 pounds. In 1940 imports were 214,000 pounds, valued at $35,775.

Chief uses of spermaceti are as a base for ointments and similar preparations, and in the manufacture of candles. The price of spermaceti in the early part of June, 1942 was 26 to 27 cents per pound. During 1941 the price was approximately one cent lower.

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Sphalerite

See Zinc

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Spiegeleisen

A VARIETY of pig iron used for the addition of manganese to steel, spiegeleisen usually contains about 15 to 30 per cent of manganese. A content much higher than that is known as ferromanganese. Spiegeleisen contains, also, 4 to 5 per cent carbon and the product finds special use in recarburizing and deoxidizing steel in the Bessemer converter. Spiegeleisen, cheaper than ferromanganese, can be made directly from low-content ores.

Shipments of spiegeleisen from domestic furnaces in 1940 rose 26 per cent over 1939. The average value per net ton at furnaces was $29.18 in 1940 compared with $26.17 in 1939. The entire production, which increased to 114,119 net tons in 1940 from 102,470 tons in 1939, was made in blast furnaces. Output in 1940 averaged 20.42 per cent manganese. Only 33 tons of foreign manganese ore was used in the manufacture of spiegeleisen in 1940.

In July 1942, spiegeleisen, f.o.b. furnace in carlots was quoted at $36.00 per ton for the 19 to 21 per cent grade and $49.50 per ton for the 26 to 28% grade.

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Spodumene

A LITHIUM-ALUMINUM silicate, a deposit of which exists at Tinton in the Black Hills of South Dakota, spodumene has properties which make it valuable as a ceramic raw material. A mixture of 25 per cent spodumene with 75 per cent feldspar is an active vitrifying agent because it melts or deforms at only 1,110° C., which is about 125° below the minimum temperature normally employed in semivitreous china bodies. This low melting point is of particular advantage in manufacturing glazes and metal enamels.

Production at Tinton is expected to start in 1942 at a mill being erected to prepare special mixtures of these minerals. A similar product, already on the market, consists of a mixture of feldspar and spodumene which occurs in large quantities in the pegmatites of Kings Mountain, N. C.

Spodumene, a powerful fluxing agent, reduces the wear and tear on refractories in the processing of enamel because it lowers the maturing temperature. Statistically, spodumene is included in lithium minerals and compounds of which United States producers sold 1,961 short tons in 1940 valued at $79,679 against 1,990 tons valued at $97,000 in 1939.

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Sponges

SPONGES are described as a product of nature classed as the lowest type of animal life. When taken from the ocean bed, in depths ranging from 20 to 80 feet, they are covered with a thin skin film which must be removed by scraping with knives. Sponges multiply by the offcast of eggs, produced by two separate sponges, not necessarily male and female. Principal production in the United States is at Tarpon Springs and Key West in Florida. Each year, about a million dollars' worth are produced in the United States. Industry uses sponges in connection with pottery, glass, tile, and optical lens manufacture. For cleaning purposes, they are utilized by housewives everywhere and by commercial cleaning establishments. Sponges are marketed in bales gross weight, less 3% tare, average weight 54 pounds, standard packing. They are priced either by the pound or by the piece. May, 1942, prices on the No. 1 grade forms ranged about $12 to $13 per pound. A year previous the price was about $7.00. Prices naturally vary with quality, size and shape. They will keep indefinitely. Principal types used by industry are: Rock Island Sheepswool and Florida Yellows. Dupont cellulose has greatly replaced the natural sponge, partially because production in 1942 was running only about 20% of the previous year. Sponges are imported from Cuba, with an import duty of 20% on "wool" and 15% on "grass."

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Spruce

IN 1940, spruce cut for lumber amounted to 402,473 thousand board feet and included "Engelmann spruce", Sitka spruce and other species. Spruce falls within the "softwood" lumber classification.

The wood is white and has a straight, even grain. It is more difficult to work than pine, being tough and elastic. It is lighter in weight than many other lumbers, about 35 pounds per cubic foot. Consequently, it has enjoyed extensive use in airplane manufacture. Normal use goes mostly to pulp making, containers and many general uses.

The OPA, by Price Regulation No. 109, fixed maximum prices on "aircraft spruce", defined as Sitka spruce, Red spruce, or White spruce.

And, on June 10, 1942, Price Regulation No. 161 covered Softwood lumber—west coast logs. This regulation covered Douglas fir, western red cedar, western hemlock, western white fir and noble fir, sitka spruce and Douglas peeler logs—the major species of west coast softwood logs.

Production of white fir in 1940 totaled 120,556 thousand board feet; hemlock cut totaled 716,077 thousand feet (Washington was the leading state); while white pine production was 1,124,490 thousand feet of which one-third was contributed by Idaho. Cedar production, including incense cedar, Port oxford cedar, western red cedar, and other varieties amounted to 294,352 thousand board feet. Other softwood lumbers were cut in the following quantities in 1940: larch, 131,295 thousand board feet; balsam fir, 12,583.

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Spruce Pine

See Southern Pine

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Steatite

See Soapstone

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Steel

See Iron and Steel

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Steer Hides

See Cattlehides

Strontianite

See Strontium

See Strontium

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Strontium

THE war wrought vast changes in the strontium industry. Imports of strontium salts from Germany, the sole source, were cut off and domestic mines resumed production on a small scale for the first time since 1918.

Strontium is a metallic element of the alkaline earth group resembling barium in its properties. It occurs in the minerals strontianite and celestite, has a specific gravity of 2.54 and a melting point about 900° C. It is pale-yellow in color and decomposes water. It is difficult to obtain as a metal but as a compound has many uses. England has been the principal source of strontium metals.

Excluding a considerable tonnage of celestite ground for use in oil-well drilling fluid as a weighting agent (displacing barite), domestic production—reported by six producers in California, Ohio, Texas and Washington—was less than 350 tons in 1940. Since then, production has expanded and high-grade deposits of celestite and strontianite have been discovered in South India, and a deposit of high-grade celestite is being developed in Mexico with exports already started.

The minerals celestite and strontianite are employed principally in the manufacture of strontium chemicals, although ground celestite is used in fairly large quantities for purifying caustic soda for the rayon industry and strontianite on a semicommercial scale in Europe for desulfurizing and dephosphorizing steel.

Strontium nitrate $Sr(NO_3)_2$—a yellowish-white crystalline powder—is used in peace times in railroad flares and signals and is considered essential for military flares and rockets. This strontium salt is prepared by roasting celestite, leaching out the strontium sulphide and dissolving the strontium carbonate in dilute nitric acid. The commercial product, which is soluble in water but not in alcohol, gives a beautiful crimson flare and furnishes the oxygen necessary for combustion. The normal flare compound contains 50 per cent strontium nitrate, 37 per cent potassium chlorate, and 13 per cent shellac to serve as a binder and furnish heat of combustion. Strontium compounds are also necessary constituents of tracer bullets and shells. In the past the German beet sugar industry used strontium hydrate for desaccharizing beet-sugar molasses. Compounds are also used in cathode-ray tubes and other devices for the emission of electrons and in medicinal preparations.

Strontium sulfate (powdered celestite) acts as a brightening agent in colored paints and as a filler in sealing compounds for electric batteries, asphaltic compounds, rubber, sealing wax and other things. The United Kingdom is estimated to use from 2,000 to 4,000 tons annually in that direction. Germany is said to use strontium carbonate to produce special high-grade alloy steels and to some extent in the manufacture of glass, ceramic glazes, and enamel.

In July 1942 domestic strontium nitrate, in barrels, on a carload basis was priced at 7¾¢ per pound at the works. The oxalate in barrels was quoted at 44¢ per pound; the "technical" carbonate, 90%, in barrels was nominally 25¢ per pound while the technical chloride was quoted at 23¢-25¢ in barrels. The iodide, in 5-pound bottles was priced at $3.06 per pound, while strontium bromide was quoted at 53¢-55¢ per pound.

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Structural Clay Tile

STRUCTURAL CLAY TILE may be defined as a building unit of burned clay, generally hollow in form in which the hollow cells exceed twenty-five per cent of the volume of

the unit. Tile units are produced in a wide variety of sizes and shapes. The most common face sizes are 5 x 12 inches, 8 x 12 inches, 12 x 12, or 8 x 16. Widths of these units vary from 2 to 12 inches in nominal wall thicknesses.

The shales or clays from which tile are made are won by surface digging, quarrying or mining depending on the nature of the deposit. The clays are then ground and mixed with water, extruded through a die, cut to size while in a plastic state, and then dried and fired in kilns at high temperatures.

The clays and shales from which tile are made abound in all sections of the continental United States. The industry shipped approximately the following quantities during 1941:

Load-bearing back up tile, 617,000 short tons; nonload-bearing partition tile, 599,000 short tons; unglazed hollow facing tile, 208,000,000 in brick equivalent.

Structural Clay Tile is used for load-bearing and partition walls, as fillers in floor construction, and as fireproofing around steel and concrete structural members. Tile may be used as an exterior or interior facing as many types of colors and finishes are produced, or they may be used as a base to receive plasters.

The marketing unit is per 1,000 units and price varies with size. Transportation is by rail, motor truck or water. This product is not ordinarily packed in containers except in the case of high grade unglazed facing tile.

Principal types are as follows:

a. Hollow unglazed facing tile.
b. Load-Bearing clay tile (for use in structures where the walls carry all or a portion of the load.)
c. Nonload-Bearing clay tile (for use in partitions or as fillers).

Competitive materials are concrete block and gypsum units.

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Stucco

See Cement

★ ★ ★

Styrene

See Polystryrene

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Sugar (Beet)

REFINED beet sugar is chemically the same and identical in appearance and taste with the cane product, but the original form is quite different from the cane. Sugar beets are white and larger than the ordinary, red, garden beet. Unlike sugar cane, which is first made into raw sugar, beets go into the factory by one door and leave in the form of finished refined sugar.

World production of beet sugar in the 1941-42 season, according to fragmentary information, is indicated to total about 10.9 million tons, or about 1.8 million tons less than the record output in previous seasons. The principal reduction was in Russia where hostilities in the summer and fall of 1941 destroyed a large portion of the growing beet crop. With the exception of production of about 2. million tons in the United States, about one-half million tons in Britain, 100,000 tons in Canada — and production of about 850,000 tons in Russia (the normal crop is about 2.5)—the Axis and Axis-dominated countries produce the balance of the world's beet sugar.

Domestic sugar beets are grown by nearly 100,000 farmers in nineteen Central, Lake and Western States. About one hundred factories, situated at strategic points throughout the country, usually contract for the farmers' crops long before harvest begins and payments are based on a fixed percentage (about half) of the price received by the beet factory for the refined product.

Harvesting of sugar beets starts in California in July, reaches a peak in October

and, of course, must end before the ground is frozen. The usual "run" of a beet factory is about 100 days—on a twenty-four hour schedule. Care must be taken to prevent freezing and subsequent thawing of beets while piled awaiting processing. Beets are cut into long strips, called cossettes and hot water extracts the sugar.

Juice purification, filtering, and then evaporation finally produces a juice ready for crystallization. From that point on, the process is very similar to that employed by refiners of cane sugar.

For details on the establishment of maximum prices, rationing, etc. see Sugar (cane).

In order to compensate for the smaller imports of cane sugar along the eastern seaboard, the War Production Board on March 27, 1942 ordered beet sugar processors to set aside 15 per cent of supplies and 15 per cent of future production for delivery as ordered by WPB. Later this sugar was moved into eastern seaboard States on consignment, and through sales, with the Defense Supplies Corporation in most cases absorbing extra freight charges involved in the long haul.

In mid-1942, with harvesting already started in California, beet companies were worried about the storage problem. Although initial Crop Reporting Board estimates of the 1942-43 production do not fully indicate it, company officials are predicting a record crop of about 2 million short tons raw value, or close to 40 million 100-pound bags of refined beet sugar. It is pointed out that this is enough to supply the eight-ounce ration to every man, woman and child in the country.

* * *

Sugar (Cane)

SUGAR in the form of either cane or beet is grown in practically every country of the world—the cane in all tropical and semitropical lands and the sugar beet in the temperate zones. Production of sugar has moved from area to area for hundreds of years as a result of war, weather, discovery, and especially tariff and subsidy treatment. Because of its relatively low price as a foodstuff it has been called the "political football" of the world. Nearly every country, whether producer or consumer on balance, now applies some form of control to production, price or movement of sugar. The war served to further aggravate this situation.

The sugar cane is a tropical perennial of the grass family, growing to a height of from five to fourteen feet. The cane takes from twelve to twenty months to ripen; grows in clumps; and in most areas is not replanted annually but rather merely cut again and again from the same clump, called "ratooning."

Chemically, sugar (sucrose) has the formula $C_{12}H_{22}O_{11}$.

Ripe cane is passed through a series of rollers to extract the juice, which is treated with chemicals—lime, sulphur dioxide, carbon dioxide, or phosphate—and then heated. "Evaporation" follows, after the heat has precipitated certain impurities. The evaporation process, which is closely controlled, produces crystals which are then separated from the residual juice or molasses by a "whirling" centrifugal. The product is raw sugar, of about "96 degrees polarization," or, in lay terms, 96% pure sucrose.

The refining process—which produces the white sugar for the consumer—is merely a series of further purification and decolorization. And the American public buys as near pure sucrose as capital and chemistry can produce.

The war has interrupted international sugar trade and made unavailable the usually complete details on world production and consumption. However, in normal times Cuba produces about 4 million tons of cane

sugar and is the world's leading exporter. (A crop of 5 million tons is rated as possible for 1943 but lack of shipping facilities may necessitate restrictions on yields). British India produces close to 5 million tons annually but most of it is a low-grade sugar consumed locally. Hawaii's yields run about one million tons while Puerto Rico and the Philippines are each able to top one million tons from their acreage. Java, once in the 3-million-ton class, has been producing about 1.5 million tons during recent years. Other important producers are: Brazil 1.1 million (mostly consumed at home); Florida 100,000 tons; Louisiana 500,000 tons; Peru 0.5 millions; Dominican Republic 0.5 millions; Br. West Indies 0.6 millions; Australia 0.8 millions; South Africa 0.3 millions; Mauritius 0.3 millions; Fiji 0.1 millions.

The United States is the world's leading consumer of sugar. In 1941, about 5.5 million tons of cane and 2.0 million tons of beet sugar were consumed. Britain, in normal times, uses about 2.0 million tons of cane sugar and 0.5 million tons of beet, produced on the island. As we mentioned earlier, British India consumes most of her 5 million ton production. Canada takes about 0.4 million tons of cane, China about 0.7, Java 0.4, Brazil 1.0—to mention other consumers. The European countries, naturally, depend mostly on beet sugar.

Consumption of beet and cane sugar in the United States in 1941 was estimated at 7,433,000 short tons raw value, about 600,000 tons higher than the previous record use and about the same amount beyond the average use during the previous four or five years. According to the Department of Commerce, estimated use by various types of distributors was as follows: Household and restaurant 4,594,000 (61.9%); baking 682,000 (9.2%); candy and confectionery 478,000 (6.4%); canning and preserving 395,000 (5.3%); soft drinks 290,000 (3.9%); flavoring extracts 286,000 (3.8%); dairy products, including ice cream 240,000 (3.2%); chocolate and cocoa 169,000 (2.3%); other industries 299,000 (4.0%). The increased consumption in 1941 was attributed to the increased consumer purchasing power.

The loss of the Philippines and the interruption of shipments from Hawaii, coupled with the need for molasses for alcohol for smokeless powder, and the lend-lease requirements for Russia and Britain, necessitated rationing of consumers and industrial users but the main reason for the shortage was lack of adequate shipping facilities.

In mid-August 1941, the OPA placed a ceiling on duty-paid raw sugar at the mid-July price of 3.50¢ per pound N. Y. basis. In January 1942, this ceiling was raised to 3.74¢. This latter action was taken subsequent to the purchase of the Cuban crop by the Defense Supplies Corporation at 2.65¢ per pound f.o.b. Cuban ports. In January 1942, also, a ceiling price of $5.45 per 100 pounds was placed on cane refined sugar ($5.35 on beet). Later, because of increased costs, northeastern refiners were permitted to charge $5.60.

Early in May, 1942, the OPA established a household and industrial rationing program which called for a 30 per cent reduction from 1941 in the use of sugar by manufacturers and a 50 per cent reduction by public eating houses and institutions. Consumers were allotted one-half pound per person per week. Many amendments, bonuses, and exceptions have been made and are being made to the rationing program, but little hope is held for an early end to rationing.

The International Sugar Agreement, promulgated by twenty-one producing and consuming countries in 1937, is naturally of only nominal importance under war conditions. Likewise, on April 14, 1942, President Roosevelt issued an order suspending the operation of United States marketing

quotas under which United States supplies have been controlled since 1934.

In July 1942, the OPA declared that the original intent of the rationing plan was to reduce American consumption of sugar to 5,700,000 tons and to include sugar required by the armed forces and lend-lease. It was estimated that 2,360,000 tons will be produced in this country (1,860,000 beet and 500,000 cane). The remainder must necessarily come by sea. The Shipping Priority Committee, had established quotas for imports from June 1 to Dec. 31, 1942 as follows: Cuba, 1,200,000 tons; Puerto Rico, 450,000 tons; Hawaii, 450,000 tons; Virgin Islands and elsewhere 55,000 tons. If these quotas remain unaltered, Cuba will carry over almost 2 million tons at the end of 1942 while Puerto Rico will be holding about 300,000 tons and Hawaii, depending on the rate of production, several hundred thousand tons. Thus, while sufficient sugar is available in producing areas to supply the normal needs of the country, the rate of imports remains far below normal.

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Sugar Pine

See Ponderosa Pine

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Sulfa Compounds

SULFANILAMIDE AND SULFAPYRIDINE have become widely accepted in recent years as medicinal agents, particularly in counteracting streptococci bacterial activity. The original discovery of the sulfonamide drugs was made in 1934, when it was found that compounds such as 2′:4′ diaminobenzene-4-sulphonamide were valuable in the treatment of septicemias. Later the shortened name of sulfanilamide was adopted for this chemical compound. In rapid succession a number of salts of this and similar compounds were offered on the commercial market under a variety of brand names.

As a result of the intensive research that accompanied the introduction of the early sulphonamides, sulfapyridine was developed. Chemically this material is 2-(para-aminobenzenesulphonamido) pyridine, and it has shown especially promising results in the treatment of pneumococcal infections. It was known at first by its laboratory designation of "M and B 693."

In 1940, five producers of sulfanilamide made 543,802 pounds of the material, said to be approximately 25 per cent less than the previous year, due to the increased consumption of newer compounds of the same type. Sales of sulfanilamide in 1940 totaled 494,983 pounds, valued at $670,311. The production of sulfapyridine and its salts in 1940 in the United States amounted to 102,196 pounds; with sales totaling 76,171 pounds, valued at $1,134,097.

Among the other new "sulfa" medicinal materials are sulfathiazol, sulfaguanidine, sulfadiazine, and butyryl-sulfanilamide. Sales of sulfathiazol in 1940 in the United States amounted to 91,907 pounds, valued at $1,332,283. In all, it is estimated that some 2,000 sulfonamide derivatives have been produced during the research on such materials, and that many thousand more are possible. Those now enjoying large commercial production are generally packed in drums containing up to 100 pounds of the material.

The price of sulfanilamide in recent years has been about $1.25 per pound in large quantities. Sulfapyridine on January 1, 1941 was being sold in 5-gram vials, costing $1.25 per vial. On January 1, 1942 the price of such vials had dropped to 50¢. On June 1, 1942, sulfapyridine was being quoted at $7.50 per pound in tins and bottles. Sulfathiazol on June 1, 1942 was quoted at $5.00 per pound in large quantities.

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Sulfanilamide

See Sulfa Compounds

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Sulfapyridine

See Sulfa Compounds

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Sulfate of Alumina

See Alums

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Sulfathiazol

See Sulfa Compounds

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Sulphate of Potash-Magnesia

See Potash

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Sulphite Pulp

See Paper

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Sulphur

SULPHUR is one of the non-metallic elements. It is commonly found in the form of native sulphur (also referred to as brimstone), sulphides of many metals, and sulphates. In the United States the most important form commercially is native sulphur, hereinafter referred to as sulphur. As marketed, this form is a yellow, powdery material, the run of mine product varying in size from fines up to lumps as large as 12 inches in diameter.

Sulphur is produced by the Frasch process. Wells are drilled into the sulphur-bearing formations, which occur in the cap-rock of geological formations known as salt domes. Through systems of concentric pipes, superheated water is forced into the formations to melt the sulphur. The molten sulphur is pumped to the surface with compressed air, piped to large storage vats, and allowed to cool and solidify.

Production by this process is in the states of Texas and Louisiana.

In 1941, 3,150,000 long tons were mined.

Sulphur is one of the most widely used raw materials. The principal consuming industries are chemicals, fertilizer and insecticides, pulp and paper, explosives, dyes and coal-tar products, rubber, paint and varnish and food products. About two-thirds of this sulphur is consumed in the form of sulphuric acid. The principal sulphuric acid consuming industries are fertilizers, petroleum refining, chemicals, coal products, iron and steel, other metallurgical, paints and pigments, explosives, rayon and cellulose film, and textiles.

Sulphur is marketed in long tons. The base price is $16 per long ton f.o.b. mines. Early in 1942, Freeport Sulphur Company, one of the largest producers, gave a voluntary pledge to the Office of Price Administration not to increase the base price throughout 1942.

Sulphur is transported in bulk by rail or water. It is not perishable.

There is one grade, guaranteed better than 99½% pure and free from arsenic, selenium and tellurium.

Sulphur production and stocks have been sufficient to meet all current demands, and consumers consequently have not been faced with the necessity of finding substitutes. At the beginning of 1942, the industry was reported to have large unmined reserves and plant capacity capable of even greater production.

There is no duty on sulphur and no appreciable imports. A substantial amount is exported.

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Sulphuric Acid

See Sulphur

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Sunflower Oil

THE SUNFLOWER contributes to the necessary supply of edible oils going into margarine and hydrogenated shortening, and, of course, into salad oil. Annually, millions of pounds of oil are obtained by applying hydraulic pressure to the sunflower seeds, cultivated for their oil in many lands, including Russia, Argentina, Central and Southeastern Europe, India, China and the United States. Exact figures on production are not available but the output does not compare with the production of competitive oils such as cottonseed, soya bean, corn and peanut. Imported oil pays a duty of 2¼¢ per pound plus 10% ad valorem. There is only one grade marketed, priced in May of 1942 at 10¼¢ per pound, New York, plus marine and war risk insurance.

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Superphosphate

SUPERPHOSPHATE was formerly known in the fertilizer industry as acid phosphate, and is the material produced by the action of sulphuric acid on phosphate rock. A mixture of hydrated monocalcium phosphate and calcium sulphate is the result. Phosphoric acid is sometimes substituted in part for the sulphuric acid.

Production of superphosphate during 1940 was 4, 385,971, short tons, calculated on the basis of a 16 percent available phosphoric acid content. In 1939, the output was 3,801,194 short tons. Commercial shipping is usually either in bulk carloads, or in bags containing 200 pounds, 125 pounds or 100 pounds.

The phosphorus pentoxide content of superphosphate determines its commercial value, generally termed its phosphoric acid content. The usual commercial grades specify 16 percent phosphoric acid and run-of-pile. A slightly higher grade guarantees at least 20 per cent phosphoric acid content. A triple superphosphate, having a 40 to 48 percent phosphoric acid content is also encountered.

Superphosphate is strictly a fertilizer material. On June 1, 1942, the 16 percent run-of-pile material was quoted at $9.60 per ton. At the start of the year the comparable quotation was $9.50, and at the beginning of 1941, $8.00.

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Swordfish Liver Oil

See Fish Liver Oils

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Sycamore

See Hardwoods

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Synthetic Resins

See Plastics

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Synthetic Rubber

DESPITE the impression which might be gained from the daily press, synthetic rubber is a material that is well known to industry. However, with the fall of Malaya and the Dutch East Indies, our automotive nation became acutely conscious of the importance of rubber substitutes.

The following information on synthetic rubber is divided into two parts. The first part discusses the "Buna and Butyl" type rubbers which are made up largely of isobutylene from petroleum refinery gases. The second part concerns Neoprene which is produced from acetylene gas, produced in turn from calcium carbide and water, which

in combination with hydrogen chloride, makes the chemical which polymerizes to form the solid product.

This discussion is confined to the above mentioned types because, at the time of this writing, these were considered the sources for the largest potential quantity production.

However, conditions are changing rapidly in the synthetic rubber field and other types of synthetic rubber may develop rapidly into prominence.

Buna and Butyl

In 1927, the Standard Oil Company (N.J.) became interested in what the Germans were accomplishing in synthetic chemistry of various kinds. They carried out a long and involved technical study of the accomplishments of I. G. Farbenindustrie, as a result of which they made a peace-time agreement with this company. Under the terms of this agreement they learned how to do a lot of things they hadn't known how to do previously, and brought this most desirable knowledge back to the United States.

These American industrialists had not been seeking a process for making synthetic rubber, particularly. Their interest was primarity along other lines. But they did bring to their country the method for making three different types of synthetic rubber, as well as the germ of processes for making synthetic toluol and 100-octane aviation gasoline.

The three synthetic rubbers were Buna S, Buna N, and a product known as Vistanex, which was not a rubber substitute so much as it was a rubber-like substance. Vistanex lacked one big virtue — it could not be vulcanized.

Standard Oil did, of course, have a reason to be interested in synthetic rubber. Petroleum is its basic business. It has always been interested in utilizing petroleum in every way possible. Therefore, when it learned that synthetic rubber could be made from petroleum it followed this development, just as it follows other developments to expand the utility of this natural resource in the public interest. Its business was then, as it is now, dependent to a large degree on automobiles—and automobiles are virtually useless without tires, which, in turn, can not be made without rubber. So, looking far ahead, at a time when crude rubber supplies were still plentiful, this company decided it would be a good thing for the United States and for the company to know how to make synthetic rubber out of petroleum.

Standard's technologists experimented with Buna S and Buna N in an effort to improve these products. They also concentrated attention on Vistanex, ultimately learning how to produce this material so that it could be vulcanizable. This new product they named Butyl, the first successful American developed synthetic rubber to be produced from petroleum.

Today, Buna S, Buna N, and Butyl play a prominent part in the synthetic rubber picture in this country. All three of these synthetics can be made from petroleum. All three products are currently being made in this country. Moreover, we have developed sufficient experience now to manufacture these synthetic rubbers on a large scale.

Of the three, Buna S is today the most important, for the very simple reason that it is best suited for use in tires. Probably the total production of Buna S for some time to come will be turned over to the government for use in our own and our allies' military machine.

Buna S is made from a hydrocarbon known as butadiene, which at room temperatures is a gas and under pressure or at lower temperature becomes a liquid. To make Buna S, butadiene and styrene, which is secured from coal or petroleum, are placed in a huge reactor. A catalyst is then added. In this reactor polymerization takes place. This rather forbidding word simply means that the molecules of the chemicals in the reactor

undergo a rearrangement. Actually, what takes place in this reactor is a partial duplication of what takes place in a rubber tree. The rubber tree uses carbon dioxide and water as its raw materials and nature, in a way not fully understood by man, does the job of polymerizing these into rubber.

What comes out of the rubber tree when it is tapped is latex. The reactor brings forth a synthetic latex, the various chemicals having been polymerized to produce this. This may all sound very simple. The fact is that this polymerization must be very carefully controlled. Improper control might produce a product of vast inferiority or unstability. Our American technologists, however, learned how to control this reaction so that its results were uniform and conformed to predetermined specifications.

Once this latex has been made, one might say that rubber has been produced synthetically. The crux of the whole operation is the polymerization. What follows is relatively simple and is really little different from what happens to latex on a rubber plantation. After the butadiene and styrene have been polymerized the latex is drawn off and mixed with an acid to coagulate the rubber. This coagulated product must then be washed and dried to form rubber crumbs, which in turn are placed in a milling machine to produce sheets of crepe rubber. This is then cut in sizes appropriate for packing, is packed and shipped.

From this point on the synthetic product is processed just as is natural rubber. In appearance this crepe rubber looks like crude rubber in this same form. It feels like it, too. Moreover, it can be worked in the same machinery which is used to work natural rubber.

To manufacture Buna N the process is the same as is employed to produce Buna S, except that instead of styrene a chemical known as acrylo-nitrile is employed. But Buna N is a different product than Buna S, although the same in appearance. It, like Buna S, is easily vulcanizable and has high abrasion resistance when reinforced with carbon black. But, its principal use is for products other than tires. It is more expensive to manufacture than Buna S and finds its greatest field of usefulness in a number of specialties. It has excellent resistance to swelling and deterioration in aliphatic hydrocarbons, mineral oils, animal oils and fats. It also has excellent aging properties and good heat and fatigue resistance.

Both the Buna rubbers are made up largely of butadiene, which may be obtained from many products, such as molasses or grain or potatoes, for example. Currently, the Standard Oil Company and other oil companies are producing butadiene from petroleum refinery gases. We have a plentiful supply of petroleum, which assures an ample supply of butadiene. The only problem is to get the steel and other materials to build the plants to convert these refinery gases into butadiene —and this is being solved.

Buna N, which is marketed by Standard Oil under the trade name Perbunan, is being used today for a great many purposes for which natural rubber was formerly used. It is not destined to play a part in the tire program at this time, so much as it is to make other rubbers available for tires by replacing them with Buna N.

Buna S makes a practical tire, either alone or combined with either natural or reclaimed rubber. Our nation's rubber technologists have worked with this rubber and know more about it than they do of any of the other synthetics. Moreover, it is fairly reasonable in cost.

So far as costs are concerned, only Buna N is made privately. It sells at seventy cents per pound, f.o.b. factory. Both Buna S and Butyl will be made only for the government, for the time being at least, and market prices of this products are consequently unavailable. Buna S costs substantially less to make than does Buna N and the cost of producing Butyl

is considerably less than the cost of turning out Buna S.

Buna S and Buna N, although definitely superior to Butyl, are not of particular interest at this time to the average civilian because his chances of getting tires made of these synthetic rubbers are rather remote just now. It is upon other synthetic rubbers, including Butyl, that he must pin his hopes. So far as Butyl rubber is concerned he can be excused for exhibiting a fair degree of optimism.

Butyl rubber has already been used to make automobile tires which have given as much as 10,000 miles of service at speeds below 40 miles an hour. It is far easier to manufacture than the Buna rubbers. Moreover, there is a distinct feeling that Butyl will be improved and developed to the point where it may well spring some surprises.

To make Butyl rubber the petroleum technologists take a refinery gas known as isobutylene, polymerize it with a small quantity of butadiene and get Butyl rubber. Isobutylene is needed in large quantities to meet our Butyl rubber goals. Fortunately, however, it is available at petroleum refineries throughout the country.

When American civilian motorists start to roll along the highways on tires made of synthetic rubber there is a strong likelihood that these tires will be made of Butyl. These tires may be expected to give as much service as the motorists of the nineteen twenties secured from natural rubber tires. This service, however, will be conditioned upon their operating their cars at speeds below 40 miles an hour. Higher speeds will promote more rapid tire wear, just as today high speeds remain the greatest single enemy of long tire life for tires made of natural rubber.

These three rubbers-from-petroleum have a wide variety of properties. They may be used not only for automobile tires, but for many other industrial uses. They may be employed for electrical insulation, for self-sealing gasoline tanks in airplanes, for belting, for tank treads, gaskets, hoses, washers, and gas masks —in fact, for virtually anything for which natural rubber was used.

In addition, the synthetic rubbers possess certain virtues lacking in natural rubber. Chief among these is their resistance to such things as oil and gasoline. Natural rubber is peculiarly vulnerable to attacks by these products. Buna S, Buna N and Butyl withstand their attacks. Oxygen and ozone have long had a most deleterious effect upon natural rubber. Butyl, however, has excellent resistance to oxygen, ozone and aging and is consequently a better electrical insulator than natural rubber.

Other properties of Butyl rubber are its low water absorption, its resistance to strong acids and oxidizing chemicals, to flexure at both low and high temperatures, its good vibration absorption qualities, its resistance to mustard gas and the fact that it may be vulcanized.

Butadiene is the one raw material which will be required in quantities to meet the synthetic rubber production goals. This product must be converted from either petroleum gases or alcohols made from grain. The question of whether to obtain it from one or the other is at present a moot one. The oil companies are securing their butadiene from petroleum, naturally. They know more about petroleum than they do about anything else. They have been making butadiene from petroleum for some little time and they have the petroleum from which to make it in quantities.

At the same time they freely state that butadiene may also be produced from grains made into alcohol and thence converted into butadiene. These agricultural products may also be converted through fermentation to butylene glycol and thence to butadiene. Furthermore, they are anxious only to see maximum amounts of butadiene produced. Their basic business is to produce, refine and

market petroleum products. The more cars there are on the roads the more petroleum products they will sell.

The oil companies have made the point that every dollars' worth of synthetic rubber will contain a dime's worth of petroleum products. Against this, they point out every car on the road uses fifteen to twenty dollars worth of petroleum products for every dollar of rubber. They cite these figures as an indication of the reasoning back of their statement that they don't care where the butadiene comes from. Their big interest is in seeing synthetic rubber made for automobile tires, the faster the better, and whether the butadiene is made from corn, molasses, petroleum or potatoes is to them a matter of relative indifference.

Neoprene

Neoprene has been produced in the United States for over ten years. During that time, it has been made into literally millions of different products for use by industry, by the professions and in the home. Production before the war exceeded 5,000,000 pounds per year, a total used by industry despite the ready availability of natural rubber and despite a wide difference in the costs of the two crude materials.

This synthetic material is produced from acetylene gas, produced in turn from calcium carbide and water. This gas is combined with hydrogen chloride to produce chloroprene, a chemical that was unknown just a few years ago. Chloroprene polymerizes to form the solid material known as neoprene or it may be stabilized as an emulsion in water to form neoprene latex. Interpolymers of chloroprene with other chemicals are practical and in this way varieties of neoprene are produced.

Neoprene is a material which looks and feels much the same as natural crude rubber. Continuing the similarity, neoprene is purchased by rubber manufacturers who combine it with other ingredients to form a compound in the same way natural rubber is compounded, process is to form finished products on rubber making machinery, and vulcanize it in this final form. As is the case with natural rubber, literally millions of different compounds are possible, each with individual characteristics which distinguish it from the others. This means that it is possible to secure a compound with high or low tensile strength, excellent or fair abrasion resistance, etc. Further, there are a number of basic types of neoprene, each designed for specific service conditions. Natural rubber is not used in neoprene compounds and it is not necessary to employ sulfur for vulcanization.

The physical properties of the neoprene products are very similar to those of natural rubber products. This means that essentially the same tensile strength, elasticity, resilience, and abrasion resistance can be secured in products made from either material. Obviously, with ample supplies of rubber available, neoprene would not be used by industry merely because of its physical properties. The reason neoprene is used is because products made from this material retain those physical properties virtually unchanged despite extended exposure to deteriorating influences. Exposure to oils will swell the neoprene product to some extent, but will have little effect on the physical properties. Some slight swelling is frequently of advantage, especially in gaskets where sealing against losses is important. Sunlight, extended aging, continued flexing, and exposure to ozone have practically no effect on a neoprene compound. Exposure to alkalies has little effect while the same is true of most acids in commercial concentrations. Concentrated nitric and chromic acids have a pronounced oxidizing effect. The halogenated hydrocarbons cause early failure. In general, each chemical must be considered separately. Extended exposure to elevated temperatures causes a gradual stiff-

ening of the neoprene product. Special grades of neoprene are usable at —70° F. Properly compounded neoprene products will not support combustion.

Properties such as those given in the foregoing permit entirely new concepts of the design of resilient parts and of assemblies embodying these resilient parts. With this new material it has been possible to utilize rubber's properties in parts where heretofore such properties were excluded because of the rapid deterioration caused by the service. It has been possible to simplify designs by eliminating the protection for the resilient parts. It has been possible to create entirely new designs. And it has been possible to reduce maintenance, increase production, by employing parts which have long life under difficult service conditions and so do not have to be replaced as frequently.

Neoprene has been used in the production of every type of product where natural rubber has been used. In normal times the unusual properties of neoprene are not required for many of these products, occasionally the physical properties of the final product are not exactly similar with those of natural rubber products. However, the extreme test of ten years service has proved the value of a "noble" rubber in literally thousands of different industrial applications.

A partial list of the products using neoprene would include molded parts of all descriptions; diaphragms; seals; gaskets; packing; wire and cable covers and insulation for cables carrying lower voltages; transmission, conveyor and Vee belting; hose of all conceivable types; coated and impregnated fabrics for protective clothing; for hospital sheeting, for blimps, and for scores of other uses; industrial shoe soles and heels and industrial footwear; protective coatings for tanks, duct work blowers and similar metal work; elastic thread; cements; tubing; gloves of all types; industrial and printers' rolls; and many other products too numerous to mention. Pneumatic tires and tubes are also made from this product.

The proved ability of this material to undertake the hard jobs has led to its widespread use in industry fighting the production battle. It is also used in hundreds of aircraft parts, in trucks, tanks and ships, in barrage balloons, and in ordnance. It has not been possible for production facilities for neoprene to keep pace with the expanded demand. These facilities have been practically doubled in each year since the introduction of neoprene, but today's demands have increased at a far greater rate. At the present time, all available supplies of neoprene are allocated each month by the War Production Board for those uses considered of the most value to the War effort. Aircraft uses are, of course, of major importance, but it is also important to speed production and all such factors are taken into consideration.

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Talc

A SOFT, friable mineral, somewhat oily, talc is a hydrous magnesium silicate. It occurs in white, gray, green or red colors, has a hardness of 1 and a specific gravity of 2.8.

It is usually treated in discussions, or in statistical tabulation, in combination with soapstone—the chief mineral component of which is talc—and with pyrophyllite, a hydrous aluminum silicate. The three materials have similar physical properties (especially apparent is their softness and soapy feel).

Sales of talc, pyrophyllite and ground soapstone reached a record high of 281,375 short tons in 1940 with a value of $3,008,-320. During the year, imports chiefly of ground products totaled 28,363 tons, and exports, not counting face, talcum and compact powder in packages, amounted to 9,402 tons. The United States output was scatter-

ed among ten or eleven states with the more important ones, California, Georgia, New York, North Carolina, Vermont and Virginia. The major part of the raw materials were mined from open pits. On a value basis, talc output accounts for about 70 per cent of production, soapstone about 20 per cent, and pyrophyllite the remaining 10 per cent.

Five industries—paint, ceramics, roofing, paper and rubber—used 75 per cent of domestic production in 1940. The paint industry was the largest market, taking 24 per cent of total 1940 sales. By industries, sales (use) were as follows in 1940: Paint 24%; ceramics 18% roofing 12% Paper 12%; rubber 10%; toilet preparations 3%; foundry facings 2%; unreported uses 9%; all others (crayons, bleaching, insecticides, plaster, textile, etc.) 11%.

The entire output of pyrophyllite, about 90 per cent of the talc and a smaller percentage of soapstone is marketed in ground form. The ground or powdered product is used as an inert extender in paint; chiefly as a filler in rubber, prepared roofing paper, textiles and soap; as an important ingredient in wall tile and other ceramic products, in toilet powder, wire-insulating compounds, plaster, bleaching powders, insecticides, gas-burner tips, refractory materials, etc. Because of its softness, talc can be easily sawed or carved. Crayons for marking metal, cloth, and glass are cut from massive talc.

By far the greatest portion of imports are of the ground or pulverized material. French chalk—a high-grade block talc—is imported for use mostly for marking purposes. Italy, France and Canada, in the order named, were the principal sources of imports, including steatite, in the 1939-40 period.

Quotations on finely ground domestic talc, f.o.b. works in carload lots from $13.00 to $21.00 per short ton in July, 1942.

Agalite is a fine variety of talc while Steatite is another name for soapstone. Alberene, is a Virginia-mined soapstone while northern New York talc is known as Rensselaerite. Many talcs, when prepared as fillers, bear a trade name. Lava is a general term applied to a fired material, using talc as a basic material. Most lavas are marketed under trade names.

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Tallow

TALLOW is the general terminology applied to the heavy fats obtained from cattle and sheep. Suet, or the better grades of internal fats is absorbed in edible channels. The external fats are used for soap and candles, lubricants and for treating leather. The industrial tallows, unless bleached, are yellow to brown in color. The edible types are white to pale yellow. Tallows are composed in large measure of oleic, palmetic and stearic acids.

The United States produces more tallow than any other nation in the world. Tallow is the most important material used in the soap industry. During 1941, the use of inedible tallow in soap amounted to 1,057,303,000 pounds. This represented about 45 per cent of all the fats and oils used in soap manufacture.

In July 1942, the Chicago price (f.o.b. producer's plants, tankcars) was as follows: edible 9⅞ cents per lb.; Prime 8⅝ cents; Special, 8½ cents; No. 1 tallow, 8⅜ cents. The principal edible grades are Premier jus, Prime and Edible. The best industrial tallow is Packers No. 1.

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Tansy Oil

TANSY OIL is a yellow liquid distilled from the tansy herb, Tanacetum vulgaris. It darkens on exposure, taking on a brown hue. Cultivation of the herb for oil production

is practiced in parts of Michigan and Indiana, and the output of oil from these areas is estimated at 2,000 pounds annually. It is packed in 20-pound tins for commercial shipment. Its principal use is in medicine. The price of tansy oil on June 1, 1942 was $4.00 per pound. On the first of 1942 the price was $3.55; and a year earlier, $4.25 per pound.

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Tantalite

THIS ore, together with columbite, is the source of the world's supply of tantalum. The ore occurs principally in pegmatite dikes found in several parts of the world, the most noted deposits being in Africa, Australia and South America. Domestic production has been negligible. Although small lots of tantalum-bearing ores have come from New Mexico, Wyoming, Colorado, North Carolina and Virginia and have also been reported in California, Maine and South Carolina, the only important domestic source has been deposits in the Black Hills of South Dakota and a small output from Amelia, Va.

The ore is marketed on the basis of its tantalic oxide (Ta_2O_5) content. The Australian ores average about 65 percent Ta_2O_5 while the American variety may contain as little as 10 percent. When the columbium content in the ore is more than that of the tantalum content, the mineral is called columbie. The tantalum metal is processed from the ore by a series of chemical, electrical and powder metallurgy operations. Naturally the war has disrupted imports from Australia, the principal source of supply, but in 1940 imports had jumped to 490,460 pounds against 56,591 pounds the previous year. (See tantalum, columbium.)

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Tantalum

THE metal, tantalum, has characteristics not duplicated in any other metal or alloy. It is inert to corrosive attack from almost all acids. It has peculiar gas absorbing properties which make it highly useful in radio transmitter tubes. In the carbide form, it has a self-lubricating property which makes it an essential component in steel cutting carbide tools. Its specific gravity is 16.6; it is about twice as heavy as steel, and it can be rolled or drawn into extremely thin shapes. The melting point is high, 2850° C.

Tantalum is obtained from the ores tantalite and columbite. Tantalum's remarkable resistance to corrosion explains its use in chemical-plant equipment. Tantung "G," an extremely hard tantalum alloy, is supplied in bits and other simple shapes for tool machining metals. Tantalum is used in various types of heat interchangers, muriatic acid plants, nozzles and spinnerets for rayon and other synthetic fibers and threads, temperature-control apparatus and sundry parts exposed to chlorine and other corrosive agents.

Tantalum rectifiers are used extensively for charging batteries supplying power to railway signals, fire alarm systems, and telephone circuits. Because of its high resistance to chemical attack, tantalum is finding some use in surgery, where it is used for bone fracture plates, screws, pins and sutures.

Sintered tantalum for electrolytic condensers can now be made with a coarse, porous structure, whose many microscopic surfaces are covered with films of tantalum oxide, which gives the material its condenser qualities and which is re-formed by reaction with electrolyte if ruptured by electric overload. An important use for such condensers is for lightning and surge arresters in railway signal circuits.

In mid-1942, tantalum was quoted at $65.00 to $73.00 per pound.

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Tapioca

TAPIOCA is a whitish starch product derived from the bitter cassava plant grown chiefly in Java, Straits Settlement, and the Malay States, with smaller amounts coming from the Dominican Republic and Brazil.

The cassava products, which consist of almost pure starch, are tapioca flour, tapioca pearls and seeds, and tapioca flakes and siftings. Tapioca flour is the form used for most purposes. Pearls and seeds are in globular form and are used almost entirely for food, as are flakes and siftings.

Tapioca flour (starch) is prepared by the following operations: (1) washing the peeled roots, (2) grating, (3) sifting, (4) separating the starch by washing and settling, and (5) drying the flour.

Flakes and siftings are obtained by heating half-wet flour in pans until it forms into lumps of various sizes, which are dried and sorted by sifting.

Pearl tapioca is made from wet flour by extrusion through a perforated plate to form threads which break in falling, and are then kneaded into balls between two flat plates, followed by heating. After cooling, the pearl tapioca is sifted into various sizes such as bullet, medium, small, and seed pearl (the smallest). Pearl tapioca is not manufactured in the United States.

Tapioca waste is the protein-containing pulp remaining on the sieves. Dried and sold in pieces or ground fine (ampas), it is useful for stock feed, but has comparatively little commercial value.

No tapioca is produced in the United States. Our chief supply (93% to 97%) has always been the Netherlands Indies, of which Java is the main producer. Small amounts are produced in the Dominican Republic and Brazil. Our 1939 importation was 382,203,000 pounds.

Principal Uses by Industry	*1937 Figures*
Paper Making	26.8%
Dextrins and adhesives	24.2%
Wood manufactures	13.5%
Textiles	12.1%
Foods	10.8%
Miscellaneous	12.6%
Total	100.0%

Important Finished Products Using Tapioca: paper products, dextrines, glues, furniture, veneer, textiles, and pudding powders. The U. S. Bureau of Engraving and Printing uses tapioca dextrin exclusively for the adhesive on postage stamps and envelopes, consumption amounting to between 700,000 lbs. and 1.000,000 lbs. per year.

When tapioca starch is in short supply or relatively expensive, the following substitutes have been used:

Paper making—cornstarch; Dextrines and adhesives—corn and sago starches; Plywood Manufactures—cornstarch, casein and soybean blues; Textiles—corn and sago starches, casein and soybean glues; Foods—corn and arrowroot starches.

Tapioca enters the United States duty free. The war has entirely cut off the supply from the East Indies and crippled the transportation from Central and South America.

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Tar Oil

See Turpentine and Rosin

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Tartaric Acid

TARTARIC ACID is also known as dihydroxysuccinic acid and dextro-tartaric acid. It is a colorless, crystalline substance, very soluble in water. Occuring widely in nature, tartaric acid is especially abundant in grapes. As potassium acid tartrate, or cream of tartar, it is obtained as the residue

known as argols or wine lees during the fermentation processes in wine-making. Commercially the argols are redissolved after being scraped from the interior of the wine vats, and the tartrate content separated as calcium tartrate. The calcium salt is subsequently decomposed with sulfuric acid.

Production of tartaric acid in the United States during 1939 amounted to 9,814,781 pounds, valued at $2,690,682. In 1937, output of the acid totaled 10,642,838 pounds, valued at $2,484,625. Commercially, tartaric acid is packed in barrels varying from 200 to 550 pounds in content; in kegs containing 100 and 112 pounds; in 50, 25, and 5-pound boxes; and in one-pound bottles and boxes. The acid is sold in technical and United States Pharmacopeia grades. The latter product is 99.5 percent pure.

Tartaric acid is principally used as a fruit acid in foods and beverages, in the manufacture of baking powders, in photography, in the textile and tanning industries, and in medicine. During the first half of 1942 the price of tartaric acid was approximately 70¢ per pound. At the start of 1941, the price of the acid ranged from 45 to 47¢ per pound.

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Tea

TEA is the world's leading beverage, consumption of it being greater than that of any other drink except water.

China is still the world's leading tea producer although statistics on Chinese production are not complete. India, Ceylon, the Dutch East Indies and Formosa contain, in the order named, the next largest areas under cultivation. The amount of tea grown outside Asia is comparatively small but cultivation is successful in Southern Rhodesia, Peru, Annam, Iran, Kenya, and Nyasaland, the last two areas having made rapid strides during the last decade. The production of French Indo-China, while substantial, finds a market only locally.

Generally speaking, production in India, Ceylon and Java is mostly on estates whereas small farmers are the important producers in China, Japan and Formosa.

India, Ceylon and the Netherlands East Indies shipped the bulk of the tea normally moving in world commerce. The Netherlands Indies, however, ceased to be a source of supply since their seizure by the Japanese. China's yield is mostly consumed at home, although some fifty years ago nearly 300 million pounds were exported by that country. Heavy export duties and internal taxes of all kinds have been a detriment to China's international trade in tea. Exports from Japan and Formosa have risen in late years.

The British Empire and the United States are the world's leading importers of tea, with the United Kingdom serving as an important market for trans-shipment. London is *the* tea market of the world and consequently carries most of the stocks. In 1941 the United States imported 107,593,723 pounds of tea during the calendar year—an increase of 7,017,084 pounds over 1940 imports. In addition to this over-all gain, 1941 showed an increase of more than fourteen million pounds over 1940 in black teas imported. Imports of black tea totaled 95,292,172 pounds, or approximately 90% of all tea entering the United States. The greater part of these teas were produced in India, Java, Sumatra and Ceylon.

The 1940 increase was achieved in spite of the extreme hazards of war-time shipping. Although the British Empire is the world's leading tea consumer, accounting for over 2/3rds of the world's exports, consumption in the United States has continued to increase, reflecting the growing demand for tea in America. While consumption here still totals less than one pound per person per year, in terms of cups it is much higher than would appear. The annual per capita

consumption is about 150 cups. The actual number of cups per pound varies according to individual taste, with the average yield estimated at between 165 and 200 cups.

Most tea is classified as "black", "green" or "oolong", or respectively fermented, unfermented and semi-fermented. These are all produced from the same plant. After the hand plucking of the bud and of one or two smaller leaves, the leaves are processed by "withering", "rolling", "fermenting", and "firing." Black tea, after being permitted to "wither" or lose water for from 18 to 24 hours, is crushed in a rolling machine which gives it the peculiar "tea twist" and breaks the cells. It is then permitted to ferment for a few hours before "firing". Firing consists of spreading the leaves on racks and sending air, heated to about 120 degrees fahrenheit, through the racks from the bottom. The leaves which contain about 50 to 65% water when fired, depending on the country and crop, have about 30% water left after the first firing and on the second firing the water content is reduced to about 3%. Firing stops fermentation and kills all enzymes, etc. Green tea is usually "steamed" rather than "withered" and is not permitted to ferment. The oolong variety is permitted to ferment for a shorter period than the black teas. Of the United States tea consumption normally about 80% is black, 15% green and 5% oolong. The proportion of black tea consumption has been gaining. Black tea comes from all areas, while green tea is prepared mostly by Japan and China, and "oolong" by Formosa and Southern China.

Grades and Growths

Teas take their names usually from the country of production, as Javas, Sumatras, Nyasalands, Ceylons, Japans, Formosa Oolongs, etc. But teas of China and India differ vastly by sections. Some of the India teas are Assams, Calhars, Sylhets, Dooars, Terais, Darjeelings, Travancores, and Kanan Devans. China teas bear names such as North China Congous, South China Congous, Country Greens, Pinganeys, Hoochows, and Foochow oolongs.

After the teas are ready for the market, they are sifted through various size sieves which determine the grade. India and Ceylon teas are graded as follows: Broken Orange Pekoe, Broken Pekoe, Orange Pekoe, Pekoe, Pekoe Souchong, Souchong, Fannings, and Dust. Java and Sumatra teas are grades as follows: Flowery Orange Pekoe, Orange Pekoe, Broken Orange Pekoe, Pekoe, Broken Pekoes (No. 1 and No. 2), Pekoe Souchong, Souchong, Broken Tea, Dust and Bokea.

Grades relate to leaf size only.

Tea Testing

The standard method for testing tea involves the infusion for from five to six minutes of tea the weight of sixpence in about one-eighth pint of boiling water. The tester passes on the taste of the resulting sample, the scent and the appearance of the infused leaves which are taken from the water. Naturally the age of the leaves, the season plucked, climatic conditions and the method of manufacture are important influences on the finished product.

Today most tea is consumed in blend, though a half century ago it was usually taken "straight". About 80% of England's teas are sold in blended form. So expert is the tea trade in blending that teas are actually blended to suit the water (hard, soft, etc.) of the market to which they are sold. The widely advertised package blends are kept secret, but typical blends are Indian and Ceylon, Oolong and British Teas, Formosa and Ceylon and low grade blends of Congou and Gunpowder. In the United States a favorite combination is a blend of Indian and Ceylon teas of an Orange Pekoe grade.

Tea is perhaps subject to greater competitive bidding on its way to the consumer than any other commodity. The great shipping

ports of Colombo (Ceylon), Calcutta (India), and Batavia (Java) before the war supported thousands of tea experts, mostly in the employ of large companies. The port of Batavia is now in the hands of the Japanese. Auctions are held at regular intervals with published pamphlets describing the teas to be placed on the block. Additional millions of pounds of tea go to the London auction market. Prior to the war most of Formosa's output left the port of Taikohu while shipments from Japan centered at Shimizu. Hankow, Foochow and Shanghai shared in the Chinese export trade.

Since 1897, all imports of tea into the United States must enter bonded warehouses pending official examination. Until 1940 the Secretary of Agriculture annually before February 15 appointed a Board of Tea Experts of seven men, who fixed standards which became effective on May 1st of each year. In 1940 the Board was transferred from the administration of the Food and Drug Department of the United States Department of Agriculture to the Food and Drug Administration of the Federal Security Agency.

This Board, incidentally, is the only such official body in the world, and the standards it establishes are higher than those of any other country, England and Canada not excepted. Only a standard of the lowest grade is fixed and price is not mentioned. The teas entering the country are tested for artificial coloring as well as for "facing," both of which are sometimes used to improve appearance. Tea is usually packed and shipped in chests of 90 to 118 pounds (oolong 60 pounds); in half-chests which vary in weight from 44 to 70 pounds; and in boxes which generally weigh from 17 to 21 pounds. Samples are usually taken by the insertion of a long hollow iron rod through a hole bored in the top of the chest.

Wholesale prices of tea, which had remained stable during the four months previous to the outbreak of war on Dec. 7, 1941, increased sharply after that date, despite substantial stocks of tea in the United States. The primary cause of the price rise was buying in anticipation of a shortage of shipping space. The OPA declared that its studies showed that prices prevailing from October 1 to October 15, 1941 were fair and equitable to producers and consumers, and consequently, through Price Schedule No. 91, fixed maximum prices for tea effective on and after Feb. 3, 1942. Maximum prices were established for "common," "medium" and "fine" grades for India, Ceylon and Southern India, Java and Sumatra, and for Chinese teas. India's Orange Pekoe was priced at 42¼¢ per pound for "common," 47¼¢ for "medium" and 51¢ for fine, ex dock New York. Increases in war risk, ocean freight and marine insurance above the rates prevailing prior to Dec. 8, 1941 were permitted to be added to maximum prices where actually incurred by the seller.

Effective March 27, 1942, the War Production Board by Order M-111 restricted the amount of tea which packers could deliver, and wholesale receivers accept, to 50 per cent of the business done during the same period of 1941. Subsequent supplementary orders made minor changes in tea quotas.

The Tea Bureau, in August 1942, estimated that on June 30, 1942 the supply of tea on hand in the United States amounted to 4½ months' normal supply and 9 months' supply under the Order limiting sales to 50% of 1941 levels. The Bureau said that working arrangements between the United States and Great Britain, under which it appears that sixty million pounds of tea, and perhaps more during the crop year, will be allocated to the United States, were nearing completion. Sufficient shipping space to handle this allotment has been granted by the WPB, the Bureau concluded.

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Teak

"TEAK", as officially defined, means the wood of the species Tectona grandis. It is a hard, heavy wood (about 45 pounds per cubic foot), with a pleasant odor. In appearance, it looks very much like oak, is yellow in color and has a coarse graining. It is a sturdy wood and has a special immunity to attack by insects.

The United States imports teak, in log form, from the Far East, especially Burma. Thus, the war has naturally disrupted this source of supply. The War Production Board by Order M-83, made effective March 5th, has placed restrictions on the use and delivery of teak, specifying that the order covers teak "in any form of logs, hewn timbers, or lumber, including boards, planks, dimension, squares, cants, flitches, timbers and other sawed forms, whether rough or dressed."

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Tellurium

ONE of the minor elemental metals (Te), tellurium is recovered from lead and copper refineries' residue and is often combined with gold. The specific gravity is 6.2 and the melting point 450° C.

It is employed chiefly to improve the machinability of copper and copper alloys and its use has grown as a toughener of rubber and lead. Tellurium lead (about 0.1% tellurium) is resistant to corrosion, wear and mechanical break-down. Usually only about 0.5% is added to copper.

In 1940, production of tellurium in the United States was 85,622 pounds against 25,234 pounds in 1939.

Prices have held steady for some time at about $1.75 per pound.

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Tetrachlormethane

See Carbon Tetrachloride

Thorium Ore

See Monazite

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Thyme Oil

TWO thyme oils, a red and a white, are encountered in commerce. White thyme oil is red thyme oil rectified by distillation.

The quality of thyme oil is determined by its phenols content. The National Formulary standard calls for an oil containing from 40 to 45 percent of phenols. Commercially oils having phenol contents of down to twenty per cent are offered as technical oils. All are packed in 50-pound tins for shipment.

The sum of imports of thyme oil into the United States in 1940 was 21,468 pounds, valued at $26,495. Spain supplied 19,280 pounds and France 2,181 pounds. In 1939 imports were 11,464 pounds, with a valuation of $11,653. In that year Spain supplied 6,713 pounds and Morocco 4,483 pounds.

The thyme oils are used in perfumery, cosmetics, medicine, and flavoring. On June 1, 1942 the price of red thyme oil was $2.75 per pound, and the white $3.00 per pound. Quotations of January 1, 1942 were $1.85 for the red, and $1.95 per pound for the white. In 1941, at the start of the year, the prices were 80¢ per pound for the red and 95¢ per pound for the white.

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Tin

TIN is employed principally in the manufacture of tin plate, most of which goes into tin cans to protect the nation's food and other products from the elements.

The U. S. Bureau of Mines, in March, 1941, said in part "No appreciable part of the tin required by American industry can be supplied from known domestic sources,

regardless of how great the stringency or how high the price."

Tin is a silvery-white metal with a bluish tinge. Being soft and malleable it can be rolled into sheets as thin as 0.0002 inches. The specific gravity is 7.298 and it will melt at 232° C.

At least 66% of the world's tin production was under enemy control in July, 1942. Moreover, the Chinese production has been seriously curtailed.

Before the war practically all of the U. S. requirements were derived from the Malayan and East Indies areas as follows:

British Malaya	80%
Netherlands, East Indies ...	12%
Belgian Congo	4%
United Kingdom	4%

Tin and terne plate together utilizes about 45% of all tin consumed in the Country. However, in the past only primary tin has been utilized in the manufacture of tin plate, and of the total primary tin consumed the percentage is somewhat higher.

After Pearl Harbor, the source from which 92% of the tin imported into the U. S. had been derived was definitely cut off. Fortunately however things are not as bad as they might appear at first blush, thanks to the farsightedness of government officials and industrialists who had created the largest stockpile of tin in U. S. history during 1940-41.

A source of tin, possessing definite possibilities in a war-time economy, is its recovery from used cans. In this connection the Metal & Thermit Co. have made a valuable contribution in a process which they have developed for handling used cans just as they are taken from household refuse. No special preparation on the part of the housewife or garbage collector is required. It is a process that would not be profitable under peace-time conditions, but very recently it has received favorable consideration by the War Production Board and the Defense Plant Corporation, and steps are under way to install the process in several of the more heavily populated areas of the country. In such areas it is estimated that ten tons of old cans can be collected per thousand of population per year, and on this basis the collection of some 470,000 tons of used cans is contemplated. At the present time hot dipped tin plate carries about 1.08 lbs. of tin per base box, and since the recovery of tin is high in the Metal & Thermit process the recovery of tin from 470,000 gross tons of used cans would yield close to 5,000 tons of tin annually, and incidentally, but nevertheless important under present conditions, some 465,000 tons of scrap steel. However, with tin plate substitutes such as electrolytic tin plate and black iron coming into the picture the amount of tin available for recovery will be decreased, so it is not conservative to assume an average annual recovery from this source of more than 2,600 tons.

The further necessary restriction in the use of tin can be accomplished by either of two methods, a further curtailment in volume, or the use of substitute materials in the container. Fortunately, research and development during recent years, anticipatory of the present world involvement, has made the latter possible. Among the many metallic substitutes investigated, including silver, nickel, chromium, aluminum, and combinations thereof with zinc or tin, two have emerged which, together, should enable the canners of essential foods to survive and feed the armies of our nation with the types of food to which they have been long accustomed, armies so far afield that subsistence on fresh or frozen foods is out of the question. These are electrolytic tin plate carrying 1/3 or less the weight of tin coating common to the conventional hot dipped tin plate, and chemically treated (bonderized) steel carrying no tin whatsoever.

Substitution in the metal container must necessarily follow a step-wise procedure, a

process of evolution as it were. While the experimental background already has been laid, steel mills must erect and bring into operation entirely new equipment for the manufacture of both bonderized steel and electrolytic tin plate. In June, 1942, it was estimated that twelve months or more would be required to reach required capacity for the production of substitute plates. In the meantime, the can manufacturer is not remaining idle: additional organic coating equipment is being built, existing machinery is being modified, and new units constructed in order to employ the new soldering technics required with bonderized steel. Factory personnel is being trained in the new operations. Concommitantly, organic coating specialists, metallurgists, and packing technologists are engaging in an intensive experimental program to determine with exactitude to just what extent substitution could be effected. Subsitution in the metal container is something to be approached with caution. How will it influence the service life of the can as well as the hermetic properties, will it affect the color and flavor of the contents? The exploratory work completed to date has pointed the way and indicated the objective; the immediate job of the technologists is to determine for every canned item to just what extent those objectives can be attained or even exceeded. As substitute plates become available the can maker will employ them, first in cans for those products which present the least corrosion hazard, and in the least critical parts of the can. As greater quantities are made available by the steel mills their use will be extended to all parts of the can and to all those products where the experimental program now under way confirms the observations of the exploratory program already completed.

Maximum prices for pig tin were fixed under Price Schedule No. 17, which became effective August 14, 1941. Straits tin was priced at 52.00¢; English refined 51.62½¢; American refined, 99.95% pure, 52.00¢; and 99% optional brands 51.12½¢, per pound.

Consumption of tin in the United States in 1939, by finished products (tin content) in long tons follows: tinplate 36,640; terneplate 1,454; solder 17,279; babbitt 5,448; bronze and brass 6,436; collapsible tubes 3,507; tinning 2,337; foil 2,001; chemicals, other than tin oxide 455; pipe and tubing 606; tin oxide 1,010; type metal 1,139; galvanizing 1,028; bar tin 1,341; miscellaneous alloys 449; white metal 508, and miscellaneous 790 tons — a total of 82,428 tons. United States consumption in 1941 of primary tin was estimated as 100,420 tons of which 47,849 tons were consumed as tin plate.

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Titanium

USED in the form of ferrotitanium, as a purifier for steel, or as titanium dioxide — an important paint pigment — titanium is a metallic element (Ti) with a high melting point (3272° F.) and a specific gravity of 4.5. It is obtained chiefly from ilmenite and from rutile where it occurs as an oxide. The difficulty in separating it accounts for its classification as one of the rare metals. The pure metal is hard enough to cut glass, and has a silvery-white color. It can be converted to titanic oxide through heating to about 600° C. in oxygen.

The bulk of the ilmenite consumed in the United States for making pigments and much of that for alloys and other uses, has up until lately been imported from British India. (See Ilmenite). On the other hand, a much larger proportion of domestic demand has been supplied by domestically produced rutile.

The war has brought an exploration and development of titanium-bearing ores. Recent development of an extensive source of titanium ore in the Adirondack Mountains in New York State is said to have helped elim-

inate the dependence of the United States on imported ores.

The urge has been to use a greater quantity of titanium pigments in order to conserve zinc and lead and consideration has been given to the wider use of ferrotitanium in steel-making as a means of conserving ferromanganese.

Production of metallic titanium involves special precautions because of its avidity for both oxygen and nitrogen. After melting, the pure metal is easily rolled hot; in fact, a strip of 1 mm. thick can be bent cold without fracture. But the amount of titanium used pure or in metallic alloys is estimated to represent only a few per cent of the total amount consumed.

The metal, 98.9% pure, was quoted at $6.50 to $7.00 per pound, f.o.b. Niagara Falls, in the middle of 1942.

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Titanium Dioxide

A WHITE POWDER (TiO_2) is processed from ilmenite; mostly in the State of Virginia. It will keep indefinitely; is higher priced than most white pigments but has great hiding power. Its principal use is as a pigment for paints, inks, floor coverings, ceramics, rubber, etc. A recent price in carload quantities (in 50 pound paper bags), was 14½¢ per pound. Principal types are: "Regular," "Non-chalking," and "Rutile." It usually moves by either truck or rail. Lithopone is a substitute product.

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Tobacco

WESTERN civilization owes the introduction to tobacco to the American Indian. It was on Columbus' first voyage to the new continent that his men saw the natives indulging in a strange habit. By means of a peculiar contrivance, a hollow twig forked at one end, they were smoking an unknown weed. In the single end were smoldering some of these weeds, and into the nostrils was inserted the forked end. Contrary to the present custom, the Indians inhaled smoke through the nose and exhaled by mouth. This instrument they called a "tobago." The Spaniards modified the word to "tobacco" but applied it to the weed instead of to the pipe. Columbus carried some of this tobacco back to Europe with him. Jean Nicot, an ambassador from the Court of France, carried some of the plants from Spain to France and promoted and exploited the use of the unknown weed from America. And it was in recognition of this that his name became associated with the botanical name of the plant—tobaccum nicotiana.

Tobacco is now an important crop in the United States and the production requires much care and skill.

In preparing to make a crop, the farmer naturally selects a seed suitable to his soil and climate. The tobacco seed is very small; there are probably hundreds of thousands of these seeds to a pound. A tablespoon holds enough seed to plant several acres.

In the United States and other countries north of the equator, in the first three months of the year, the seed bed is prepared. The farmer selects and clears a small sunny patch of rich land, preferably in some bottom or on the leeward side of a thick patch of woods, where it will be protected as much as possible from cold weather, and cultivates this piece of ground thoroughly with fertilizer. He then places on this land several cords of wood, which are burned until nothing remains but fine ashes. This purifies the ground of germs or insects which might injure the tender young plants, and also warms it up, making easier to pulverize to a great depth. After tilling it thoroughly he broadcasts the seeds and covers the seed bed with very fine cloth. In a short time the seeds begin to sprout and the farmer

carefully watches the growth, guarding against attacks by plant diseases and pests.

Meanwhile, he has been preparing his fields for the crop, putting in the proper fertilizer and breaking up the ground as finely as possible. When the plants are from three to four weeks old he pulls them up carefully by the roots. On the same day, he transplants them in his field, watering them and if the sun is very hot, shading or waiting until the cool of the evening to get them in. Naturally, the plants will wilt somewhat, but if planted in the proper season, in the spring, the showers soon bring them out.

When the plants begin to grow and reach a certain point, little sprouts or shoots grow out at the intersection of the leaf and the main stalk. These shoots are known as suckers, because they suck the life and food away from the larger leaves, and, unless the farmer removes them, they would cause undersized, thin tobacco leaves. After a little more growth, the farmer pinches out the tops of those plants from which he doesn't wish to save the seed, which also makes the main leaves grow bigger and thicker.

Tobacco must be gathered when it is at the proper stage of ripeness, and most farmers, from years of experience, can ascertain this stage exactly. Up to this point planting and cultivating of all tobaccos are similar. However, when tobacco gets ripe there are three ways in which it is harvested and cured. In the case of the Bright Virginia, or Flue-Cured, in the eastern part of the tobacco section of Virginia, The Carolinas and Georgia, the tobacco is primed, which means that each leaf is plucked separately when it is ripe. In the old and original Bright Virginia section, when the mapority of the leaves are ripe the stalk is cut and the entire plant carried to the curing barns. Here the flue curing process begins. The tobacco is allowed to wilt slightly, and is then subjected to a certain amount of heat to drive out the excess sap or moisture. When this is accomplished, the farmer does what is known as "setting his color," that is, he wants to make his tobacco as bright a yellow as possible. At this stage, the greatest care must be exercised. If the heat is too high, the tobacco will become scorched and brown, and if not enough heat is used, or the tobacco was plucked not ripe, it is liable to show a greenish tinge.

This procedure, if carried out properly, leaves the tobacco 'alive'; improperly handled tobacco becomes dead and will not cure with a beautiful color. This same method applies to both stalk-cut and primed tobacco. Because of increased requirements for cigarettes, less tobacco is stalk-cut each year in the Old Belt section.

The Burley tobacco is handled up to the curing point and through the cutting stage exactly as the original Old Belt Virginia, but from then on this tobacco is hung in barns and on the proper kind of day, air and moisture are allowed to enter, so that it is air-cured by natural means. This tobacco is a chocolate brown color, and a large part of it is used in smoking tobacco and chewing plug, whereas the Virginia Bright is mainly used for cigarettes.

After the tobacco is cured, the leaves, if they have not been stripped from the stalk previously, are pulled off and graded according to color, length and weight. After making a pile of each of the different grades and qualities, the farmer ties up these leaves, wrapping with one of the same kind of leaves, into small bundles of about two dozen leaves, and making a neat head at the butt end of the stem. He keeps each grade separate and carries them to a market where, under an auction system, the buyers bid for the various piles.

Turkish tobacco is grown very similarly to the other tobaccos, but different soil produces in this tobacco, the peculiar and characteristic aroma which is not present

in any other type of tobacco. Also, there are many different species of Turkish tobaccos, each having its own peculiar aroma. Most of this tobacco varies from a lemon to a rich mahogany color, and the leaves are considerably smaller than the American types. Some of the small leaves are hardly larger than a man's thumb nail, while others run as large as one's hand.

Turkish tobacco is used almost exclusively in cigarettes, either alone or blended with the American tobaccos. This tobacco is grown on land rich in potash and other fertilizing ingredients, but it does not produce many pounds per acre. It is cured by both the sun and air. After it is cured, each leaf is pulled off the plant separately, small needle holes are made in the stems, and they are strung on strings until the curing process is completed. This tobacco is handled very carefully, because of its great value, the small production and great demand, and is packed flat, leaf upon leaf, in small bales. Usually these bales are purchased by the manufacturers and carefully graded out to suit their own ideas rather than that of the farmer.

The cigar tobaccos are also grown very similarly to the other tobaccos, and air cured, except in the case of the wrappers, which are made of the most expensive type of tobacco. These wrappers, to protect their very fine quality, are grown under shade. That is, entire acres are covered with thin cotton cloth to keep the sun from making the tobacco the wrong color and to keep the fibres in the leaves as small as possible. This tobacco is also air cured and packed in bales.

The United States leads the world in tobacco output, followed by India and China. Other important producing nations are Russia, Brazil, Japan, Greece, Italy, Turkey and Canada. World production prior to the War averaged about 5 billion pounds annually.

The largest producing states are North Carolina, Kentucky, Virginia, South Carolina, Tennessee, and Georgia. Production in the United States during 1941 amounted to 1,261,364,000 lbs.

Production is divided into eight major types. These are Flue Cured, Burley, Maryland, Fire Cured, Dark Air Cured, Cigar Filler, Cigar Binders and Cigar Wrappers. Each has a different use and some of the varieties are not interchangeable in use. For example, the cigarette types of tobacco are not suited for cigar production and vice versa. These specialized uses makes them non-competitive, in a sense.

Flue-cured tobacco is the most important type grown in the U. S. In average years, it accounts for more than 50% of the entire tobacco crop. It is grown in southern Virginia, central and eastern North Carolina, eastern South Carolina, southern Georgia and northern Florida. It is used in the production of straight and blended cigarettes, pipe and chewing tobaccos. In normal times more than half of the crop is exported.

This type of tobacco is often referred to as bright tobacco and the name flue-cured is derived from the process used in curing. The tobacco is cured rapidly by artificial heat sent through a series of flues or pipes; the leaf does not come into contact with the smoke.

Burley ranges second in importance to flue-cured tobacco. About 25% of the nation's annual crop consists of burley in average years. The crop is grown mainly in central and northern Kentucky, southeastern Indiana, southern Ohio, the western part of West Virginia, eastern and central Tennessee and the western portions of Virginia and North Carolina. It is used primarily in the manufacture of blended cigarettes, pipe and chewing tobaccos.

Maryland tobacco is similar to burley. It is grown in southern Maryland and is used mainly in the production of cigarettes. A portion of the crop is exported.

Both the burley and Maryland types are air-cured. The leaf is suspended in specially constructed curing barns which permit a free circulation of air. These two types of tobacco are referred to as light air-cured tobaccos.

Fire-cured tobacco is used in the manufacture of snuff, plug wrappers and is also grown for export. It is produced in central Virginia, western Kentucky and northwestern Tennessee. It derives its name from the curing process, which is effected by smoke from slow wood fires on the floor of the barn in which the tobacco is being cured.

The principal dark air-cured types are Green River, grown in western Kentucky and One Sucker, grown in western Kentucky, north central Tennessee, and southern Indiana. These are used in the manufacture of smoking, chewing, plug and twist and also grown for export. A less important type of dark air cured is Virginia Sun Cured, used in the manufacture of plug chewing tobacco and grown in central Virginia.

Cigar tobacco is divided into three main categories: wrapper, binder and filler. All are air-cured.

Wrapper types are grown under artificial shade and the chief producing areas are in the Connecticut Valley, Georgia and Florida. It is used for covering the filler and binder of the cigar.

Binder tobacco, as the name denotes, is used to bind the filler of the cigar and also acts as a protection for the wrapper during the process of manufacture. It is grown in the Connecticut Valley, Wisconsin, Pennsylvania and Minnesota.

Filler tobacco forms the core of the cigar and determines the aroma. It is grown around Lancaster, Penna., and in Ohio, Georgia and Florida.

The marketing unit is the pound although sales are usually made on a 100-lb. basis. Transportation is by wagon, truck, rail and water.

Most tobacco is marketed in one of four ways: (1) Auction, or loose-leaf floor system; (2) The hogshead market; (3) country sales; and (4) cooperative marketing.

The first method is by far the most important and is really a transition from the hogshead market. The foundation for auctioning of hogsheads was laid by the Virginia Assembly in 1712, when it was voted that public warehouses be established at points within a mile of navigable water. The farmers delivered their tobacco to these centers and after licensed and bonded inspectors had opened and inspected the hogsheads, growers were given negotiable receipts. The sale of tobacco was conducted on the basis of these "tobacco notes" for almost a century. Inspectors became lax after the Civil War and auctions evolved, based on samples laid on top of each hogshead.

The extra labor and expense entailed in prizing or packing tobacco into hogsheads on farms, and the transportation difficulties of the early nineteenth century gave rise to the practice of delivering loose tobacco to market. Today, there is only one remaining hogshead market, located in Baltimore, and this is a "closed bid" market.

Under the "loose leaf" floor system, tobacco is delivered in bundles (usually of 12 to 20 leaves) and is auctioned off to the highest bidder. In Georgia, and Florida, the leaves are not tied in bundles. Under authority of the Tobacco Inspection Act, approved in 1935, the government has extended its inspection and news services. Government inspectors certify the Federal grade on lots before they are sold and producers are so informed.

Country sales are most common in the cigar leaf districts. Here sales are made on the farm either before or after the crop is harvested and cured. In these instances, buyers come to the farm to make their purchases.

The basic principle of cooperative mar-

keting is the banding together of a group of growers to set up a compact marketing organization. The tobacco is pooled by grades and is either sold or stored until marketing conditions are more favorable.

After the tobacco has been purchased by the manufacturer, it is packed in large hogsheads containing approximately a thousand pounds. The tobacco at this stage cannot be used for manufacture, but must first be aged for at least two years, during which time it acquires the tobacco flavor and aroma. Whereas it was formerly throught that the aging of tobacco for cigarette use was a fermentation process, there is much evidence pointing to the fact that it is primarily chemical in character.

The duty on tobacco is as follows:

Tobacco unmanufactured: Leaf for cigar wrappers: unstemmed—per lb.: \$2.27½ lb., \$1.50 lb. Netherland, \$1.20 lb. Cuba; stemmed—per lb.: \$2.92½ lb., \$2.15 lb. Netherland.

Cigar leaf (filler): unstemmed — per lb.: 35¢ lb., 17½¢ lb. *Cuba; stemmed—per lb.; 50¢ lb., 25¢ lb. *Cuba.

Cigarette leaf. Unstemmed—per lb.: 35¢ lb., 30¢ lb. Turkey.

Scrap tobacco—per lb.: 35¢ lb., 17½¢ lb. *Cuba.

Stems, not cut, ground or pulverized—Free.

*Subject to quota provision.

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Toluene

See Toluol

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Toluol

A WATER-WHITE LIQUID ($C_6H_5CH_3$); distilled from light oil which has been scrubbed from coke oven gas. It has a specific gravity of 0.871, boiling point of 110°C., and solidifying point of 95° C. Is inflammable and poisonous. Chicago, Pittsburgh and Birmingham are principal points of production which in the past has reached 30 million gallons annually from coke ovens. In addition several of the major oil companies are producing a similar quantity this year, by cracking petroleum and expect to greatly increase their output in 1943. While the war has earmarked most of the production for T.N.T., in normal times there is an extensive use as a lacquer diluent and in dyestuffs. It is marketed in tank car lots, or iron drums. A recent tank-car price for the industrial grade was 28¢ per gallon while the nitration grade was priced at 1½¢ higher. These two types are known as Industrial 2°, and Nitration 1°. Xylol and Benzol are classed as substitutes.

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Topaz

See Corundum

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Trichlormethane

See Chloroform

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Tripoli

TRIPOLI is one of the lightest in weight and most absorbent silica on the market. Described as a soft, friable, porous cryptocrystalline silica of the chalcedony variety, it is mined by open pit method, air dried, and pulverized. Production is centered in a small area in Newton County, Missouri and Ottawa County, Oklahoma; in the immediate vicinity of Senaca, Missouri. About 25% of the production of about 12,000 tons yearly is normally exported to the leading countries of the world. It is marketed in two colors (Rose and Cream) in three grades of fineness; Once Ground (the coarsest); Double

* Subject to quota provision (T.D. 50050)

Ground (medium fine); and Air Float (finest). The Once Ground is used entirely as an abrasive. The fact that the particles break down as pressure is applied in the polishing operation is of considerable importance. They must not crush too easily, nor can they be too hard and resistant. A proper mineral oil absorption makes tripoli ideal for compositions and in their final use.

The Double Ground grade is used principally in the manufacture of a water-proofed dust called "Foundry Parting." This dust can be spread out in a thin film over the surface of water and have enough resistance to permit a sharp pencil being gradually pushed to the bottom of a glass of water without puncturing the film. The Duco and laquer trade are also users of Double Ground in both colors. The finest grade, "Air Float," is used exclusively in fine polishing pastes and liquid preparations. Most sales are in 30-ton carlot quantities and prices are quoted by the ton and bag-lot, bags running 100-pound paper and 200-pound burlap. In May, 1942, the three grades were priced, $16.00, $17.50, and $21.50 per ton—up $1.50 over 1940 prices; while bag-lot prices ran $3.50, $4.00 and $4.50 per 200-pound bag, up 50¢ from a year previous.

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Tuna

TUNA has grown into one of our most important fisheries and canned tuna takes its place along with canned salmon, as one of the leaders among canned seafoods.

The center of the tuna fisheries is in California. The two big ports are: San Pedro, which, in 1940, handled 42,961.6 tons of fresh tuna and San Diego, which, for the same period, handled 57,462.6 tons of fresh tuna.

Imported, fresh and frozen tuna, for the twelve months ending Sept. 30, 1940, from Japan were 2,045,882 pounds; Panama, 1,238,720 pounds; Mexico, 290,698 pounds; Costa Rica, 3,732,137 pounds and from Peru, 144,660 pounds. This is used for canning in California.

The 1940 tuna pack of California reached a new record estimated, conservatively at 3,806,785 cases. Pack figures are estimated to have run about 15% over 1939. During 1939 the pack was given at 3,305,308 cases.

When one considers that production of tuna, known as a "war baby," was about a half million cases annually from 1917 to 1924, the steady, ever-increasing pack is ample testimony of the growing popularity of this fish with the housewife.

San Pedro packed 1,547,364 cases and San Diego packed 2,255,468 cases for the year ending November, 1940.

There are four species of tuna that figure in the American commercial pack. These species are: Albacore, Yellowtail, Bluefin and the Skipjack, sometimes known as the Striped. Bonito is a member of the tuna family but, because of a different characteristic of its canned meat, it cannot be labeled "tuna." Yellowtail is not a member of the tuna family but the canned meat does resemble the tuna.

The "tonno" is a specialty pack and not a fish. It is usually Yellowfin, Skipjack or Bluefin, packed in olive oil, specially for the Italian-American trade. Tonno is packed in ½ lb. "Kanopen" cans.

White meat tuna, closely resembling chicken, (one trade name calls tuna "Chicken of the Sea") is always Albacore. Light meat tuna may be any of the other three species.

The "half flat" is the dominant factor in the tuna can sizes, taking 80% of the total volume. It averages 7 oz. net of meat. The ½ lb. tin ranks next, holding 3.5 oz. of meat. Tuna is generally packed in the "tall quarter," while salmon is the "flat quarter." The pound flat follows the ½ lb. can in importance for tuna, while small quantities are

packed in four pound containers and 12 ounce containers.

The great majority of tuna is caught south of California. Fish are found all the way from the Galapagos Islands to Puget Sound.

The major portion of the tuna catch is by clippers, running up to 148 feet in length, with Diesel engines up to 800 H.P. Live sardines are carried for bait in great tanks. When a school is sighted the sardines are thrown out to attract the fish close to the boat. Long bamboo poles are used to which hook and lines are attached. For large tuna, two poles and two men handle one hook. The fish are hooked and jerked up onto the deck.

The other important method is purse seining, similar to purse seining on the East Coast.

There are three grades of canned tuna. These are: solid pack, large unbroken pieces of meat; standard pack, largely unbroken pieces with about 15 to 20% smaller broken pieces; and flakes, consisting of smaller pieces of meat.

The Albacore pack, taken mostly in Oregon, was 153,702 cases in 1939. Washington had 15,857 and British Columbia, 3,800 cases for 1939. The 1940 pack showed Oregon with 197,535; Washington with 10,188 cases. These figures were based on 48's halves.

The Oregon pack took a jump in 1940 while Washington dropped, but the totals however, for the Northwest, (Washington and Oregon only) was 207,723 cases, well over the total 1939 pack that also included British Columbia's pack.

The tuna fisheries, like salmon, are being seriously affected by the war. The size of the tuna clippers make them ideal for navy use and, as a result, many have been taken over. The long cruises necessary for tuna fishing make it a hazardous game with enemy submarines lurking in the Pacific waters. As a result the tuna pack for 1942 was expected to drop sharply with most of the tuna pack going to the armed forces and Lend-Lease.

Canned tuna is shipped in corrugated and wooden shipping containers. Comparatively little tuna is sold as fresh or frozen.

On the East Coast some tuna was packed in Gloucester during the past two years with good success. The amount is small and a big East Coast tuna fishery is not very probable. A tuna cannery in Maine failed.

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Tuna Liver Oil

See Fish Liver Oils

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Tung Oil

THIS oil is a derivative of the tung nut, fruit of the Aleurites fordii and Aleurites montana, or tung tree. The term Chinawood oil is used interchangeably because of the oil's widespread use as an ingredient for oiling wooden boats in China as a waterproofing preservative.

As found in its natural state in the cells of seeds, the oil is practically colorless and neutral in reaction. When the oil is removed by cold pressing, it is light in color. The best imported Chinese tung oil is of a darker color, sometimes containing up to 7 percent free acid, owing to the crude methods of handling the oil in China. A pale, practically neutral oil is obtained when produced by modern American machinery.

Until recent years, China was the only source of tung oil.

Tung trees are found in Szechuan, Hupeh, Hunan, Chekiang, Kwangsi, Anhwei, Kweichow and Honan. Formerly, they grew wild on hillsides near the banks of the Yangtze River, from 500-5000 feet elevation. This peculiar habitat is caused by the tung tree's natural affinity for a mild climate. Because climatic conditions in Szechuan are particularly favorable, the tung tree has been most prolific in that province. Its wild growth on

hillsides along the Yangtze gorges is not a matter of choice, but a result of circumstances effected by the characteristically rough terrain found in that region.

In recent years, however, the commercial value of this crop has induced new plantings and cultivation to increase annual yields. Whereas formerly tung trees were suffered to remain on a farmer's land only after as much acreage as could be utilized for growing other staples were tilled, the Chinese Government endeavored to encourage additional planting to augment a lucrative crop which hitherto had been merely a source of supplementary income to the Chinese farmer.

In normal times, China produces over 100,000 tons of woodoil. Despite this enormous annual output, the basis of this native industry is supplementary cultivation. Large tung tree plantations or groves are nonexistent in China. Tung trees are not planted as a primary crop. The tung nut harvest is an incidental item after other necessary staples and produce have been planted and harvested. The trees are planted sparingly on hillsides adjacent to farmlands. The nut crop is gathered after other staple crops have been taken care of, and sold to village buyers who purchase these small quantity of nuts from the individual farmers for their little mills. Evidently then, proceeds from this source are windfalls to the farmer, who usually sells for whatever the nuts will bring, and considers this as supplementary income.

The village dealer who purchases this crop usually extracts the oil. His equipment is simple and inexpensive. After a process of drying in brick ovens, the nuts are pulverized and then dried again to remove moisture. The actual process of extraction is performed with aid of a man-powered press. The oil thus obtained is shipped in wooden tubs or paper-lined baskets to various points where trading and resale finally brings it to centers of domestic consumption or export. The source of supply in China, then, under normal conditions is plentiful, and flexible. Increased demand and subsequent high prices would induce the farmer to give more attention to his crop of tung nuts, and the reverse would serve to diminish the supply of nuts available to the local dealers. Hence the market may be overloaded or under-supplied at times, depending upon external influences which motivate the farmer's ambitions. At the same time, this situation has not been conducive to a stable market; together with speculation by traders all along the line, this has tended to result in wide fluctuations of prices in all markets during the past.

For many years, China was virtually the sole source of supply for the United States. Since 1925, U. S. consumption has averaged more than 100 million pounds annually although it slumped after restrictions were imposed on the movement from China. With Chinese supplies almost cut off by the war, increasing attention has been directed to the growth of the domestic tung oil industry. Production in the United States is expected to approximate 10 million pounds in 1942 against 5 million in 1941.

The production of tung nuts in the United States is a relatively new industry. It has been the subject of a number of speculative promotion schemes whereby uninformed people lost considerable money. These unfortunate investors were unaware in many instances that lands required for tung trees are cheap and that growing and setting young trees is not very expensive. They also did not know in many cases that trees will not grow on all types of land and that many production problems require much experience. Consequently, many mistakes have been made owing to misinformation or lack of sufficient information.

The American tung belt is in an approximate arc beginning on the lower coast of South Carolina and curving across the lower halves of Georgia, Alabama, Mississippi, Louisiana and part of Texas. It extends from

the Gulf back about 100 miles where annual rainfall is 30 inches or more. A rainfall of 40 inches annually is considered best. The trees need some cold weather and they must remain dormant for a while during the winter. After reaching maturity, they are hardy and, therefore, healthy trees will even survive zero weather. However, a late frost may kill the blossoms and thus prevent the formation of fruit. Hence, the most critical period is when the trees are in bloom.

Other complex problems must be overcome. Soil and drainage must be right. Acid soil is needed and good drainage is an absolute necessity. The proper flow of air currents also must be taken into account. The trees must be cared for and cultivated properly. With the right kind of methods, trees can be grown on land that is poor otherwise. Much thought has been given to the possibility of tung trees as a check to soil erosion in the south.

The tung tree begins to bear fruit when 4 or 5 years old. The fruit usually drops from the tree in the late fall. It resembles a russet apple although when ripe in October, it is dark brown in color. The seeds, which are the source of tung oil, make up about 20 percent of the whole dried fruit although about 16 to 17 percent is obtainable. Experimentation is constantly under way to increase the recoverable portion of oil.

The fruit is allowed to dry on the ground, then hauled to the mill where the oil is pressed. If the season is rainy, drying becomes slow and difficult while the color of the oil may be affected. Owing to this factor, new drying methods are being experimented with. Barn-drying is coming in for attention while controlled kiln-drying also is the subject of thought. Owing to the superiority of American refining methods, the domestic oil usually commands a premium of at least two cents a pound over Chinese oil.

About 75 percent of the tung trees in the U. S. are located in Mississippi. Plantings also are heavy in Louisiana and Florida. The domestic tung oil industry is constantly expanding. The number of trees has jumped from 351,000 in 1930 to about 18,000,000 in 1942.

Most tung oil is used by the paint and varnish industry. Tung oil dries by polymerization, rather than by oxidation, and it forms a hard, waterproof film which is resistant both to acids and alkalis. Its waterproofing qualities enables it to find a wide variety of uses in activities outside of the paint and varnish industry. Among these are textiles (for raincoats and other waterproof items), waterproof concrete, brickcoating, coats, fish nets, linoleum, lithographic printing and printing inks, drawing inks, insulating materials, tanning leather, etc. Military uses are currently prominent. Tung oil is used to waterproof hundreds of military items, naval and air equipment. A presidential order in January 1942 restricted the use of tung oil to military purposes and to containers preserving food used in human consumption.

The marketing unit is the pound. Early in 1942, the price per pound drums, in New York City, was 42 cents.

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Tungsten

TUNGSTEN (W) is an elementary metal, white, and with a specific gravity of 19.6—as heavy as gold. It has the highest melting point of any of the metals—6098° F.—hence its value for electric lamp filaments and contact points. The tensile strength of the metal is greater than that of any other. A wire of a diameter of less than 0.002 inches has a strength of over 500,000 pounds per square inch.

The commercial ores of tungsten are wolframite and scheelite. The composition of wolframite is $(FeMn) WO_4$. Ore with a low manganese tungstate content is called Ferberite while ore with a low iron content is

called Hubnerite. Wolfram concentrates usually contain about 65 per cent tungstic oxide while scheelite is calcium tungstate, containing in theory about 80 percent tungsten trioxide and 20 percent lime. The metal is never found in a free state.

The war put further emphasis on the strategic nature of tungsten. Shipments from China—the principal source of world supply—have now been halted. The result has been an expansion of output in the United States, Argentina, Bolivia, Brazil, Chile, Cuba, Mexico and Peru. In addition, substitution of other metals, for example molybdenum in high-speed steels, has increased. Increased demand for tungsten carbide has caused even greater worry.

Until recently, three states—Nevada, California and Colorado—supplied over 90 percent of the domestic output of tungsten minerals. In 1940, domestic production rose to 5,319 short tons of concentrates (60 per cent WO_3 basis), a 24 percent increase over 1939. Imports of ore and concentrates for consumption rose sharply.

General imports of tungsten ore or concentrates amounted to 18,481,342 pounds containing 9,666,228 pounds of tungsten in 1940. China supplied 46 percent, Bolivia 20 percent, Argentina 10 percent, Portugal and Australia 6 percent each, Peru 4 percent, Thailand and Burma 2 percent each, and Mexico 1 percent. In addition, 1,348,495 pounds of tungsten in concentrates were imported — duty free — for smelting and refining.

The principal use of tungsten is in the manufacture of tools for metal cutting. For this purpose it is employed either in high-speed tool steels or in cemented carbides, used in making the tips of cutting tools and in the production of hard dies. Tungsten carbide, an iron-gray powder has a hardness of over 9, will scratch sapphires, and withstands cutting speeds several times that of high-speed steel. New types of steel employing only 1 to 1.5 percent tungsten in place of the usual 18 percent tungsten — 4 percent chromium — 1 percent vanadium steel (the tungsten deficiency being compensated for by as much as 9.5 percent molybdenum) are being used successfully in meeting the increased demand for high-speed tool steels. The need for stretching tungsten supplies also favors the greater use of tungsten carbide. While the use of tungsten in electric-light and radio tube filaments is important, the quantity consumed is not large. For military purposes, tungsten is used as a core in armor-piercing bullets, as an erosion-resistant liner in heavy ordnance, in armor plate, and in gun breeches — to mention more important uses.

An emergency stockpile of tungsten was authorized by the Strategic Materials Act of 1939. Early in 1940, the RFC agreed to purchase all ore available from Indo-China and later the Metal Reserves Co. — RFC subsidiary—arranged to accept $30,000,000 worth of tungsten from China in repayment of an Export-Import Bank loan, delivery to be made over a period of years. Subsequently, another loan of $60,000,000 was arranged to be repaid by sales of tungsten, antimony, and pig tin to the United States. Government purchases of tungsten ores in 1940 included 2,000 short tons of California scheelite, in addition to Chinese Wolframite, above mentioned; and 7,300 tons of ores from China, South Africa and South American countries.

Export control of "tungsten ores, and concentrates, metal, alloys containing in excess of 5 percent tungsten and tungsten compounds" was effected on July 2, 1940. Ferrotungsten was later added to the list. Deliveries of tungsten by producers were first limited under Order No. M-3 and M-3a which on August 30, 1941 were replaced by Order M-29, and, subsequently, M-29-a and M-29b. Deliveries, of more than 25 pounds per month to any person, require permission

of WPB. The use of tungsten in specified products during Feb.-April 1942 was restricted to $17\frac{1}{2}\%$ of the amount used during the twelve months ending June 30, 1941 and, thereafter, use in these articles was prohibited. Other limitations are also provided.

In July, 1942, tungsten ore in New York, duty paid, Chinese wolframite 65 to 70% WO_3 grade, per unit, 1%, was priced at $25.00 per short ton. In August 1939, the price was $18.50, while the 1931-1933 average of prices was about $11.00 per ton. South American ores were reported being bought at about $21.00 by the Government. Domestic scheelite was quoted, nominally, at $25.00 per short ton unit (20 lbs. WO_3) while hubnerite, delivered, was quoted by the American Metal Market at $24.00-$25.00 per unit. Tungsten metal powder, 90%, in drums, at the works, was quoted at $2.60 per pound.

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Tupelo

See Hardwoods

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Turpentine and Rosin

THE raw material of the naval stores industry is pine oleoresin, derived mostly from the pine trees of the South. The term naval stores dates back to the days of the wooden ships when the crude oleoresin, obtained from the southern yellow pine, was used to calk the seams of the boats. It was used also to treat the ships' rope and even to plait the hair of the sailors. With the decline of the wooden sailing vessel in commercial importance, the term "naval stores" was associated with but one group of products—turpentine and rosin—and in a broader sense, to the resinous, tarry and oily products of the southern pine.

The main commercial sources of naval stores today are the longleaf pine and the slash pine, both growing in the South. The resinified stumps and "lightwood"—the resinous wood remaining after the sapwood has rotted off—also yield naval stores products. This latter group is known as wood naval stores, accounting for about 35 per cent of the nation's output. About 65 per cent comes from the living tree.

Crude pine gum, the source of gum turpentine and rosin, is produced in the following manner. Some of the inner bark of the tree is cut periodically — usually each week—with a tool having a V-shaped blade called a hack. This procedure is known as chipping and each wound is in the shape of the letter V, known as a streak. The oleoresin or gum that is released from the resin ducts by the cuts flows into a collecting receptacle called a cup. Most cups hold about 3 pints and they fill about once a month after about 4 chippings. Cups are emptied into buckets, then into barrels and taken to the distillery or "still" where turpentine and rosin are recovered by a distillation procedure. About 18 lbs. of turpentine and 70 lbs. of rosin are produced from 100 lbs. of crude gum. The naval stores producing season begins April 1 and ends the following March 31.

Obtaining the products from the stumps and top wood is a very different story. Regular crews work the cutover land in Georgia, Florida, Alabama, Mississippi and Louisiana, pulling or blasting the stumps which must be quite ripe—ten or fifteen years old, bare of bark and with nothing left but the heartwood in which the resinous materials are concentrated.

The stumps and top wood are broken up into a convenient size for shipping and at the "Steam and Solvent" mill they are reduced to small chips or shreds by hogging and shredding. At the mill where the destructive distillation process is used, they are cut to suitable lengths for packing into the

retorts or kilns. In the case of the "steam and solvent" process the wood is first treated with steam, which removes the major portion of the volatile oils. After steaming, the rosin and the balance of the volatile oils are extracted with a suitable solvent. The mixture of oils obtained in the steaming operation is fractionated into three principal fractions—turpentine, intermediates and pine oil. The rosin liquor or extract obtained in the extraction step, consisting of rosin, solvent and pine oil, is given a preliminary refinement and then it is subjected to a dry, vacuum distillation, a steam distillation or a combination of the two. In this manner, the solvent and pine oil are removed from the rosin and separated from one another. The rosin thus obtained as a still residue is the natural "FF" color grade wood rosin. This rosin may be further treated and refined to produce rosin of various types and color grades. Close control of the operation permits the production of chemically "tailor made" main and by-products, including anethol, fanchone, camphor, dipentene, pinene and alpha terpineol.

In the case of the plants employing the destructive distillation process, the wood is placed into retorts or kilns which are equipped with condensers and heated to the charring point, either by direct fire or hot gases. As the distillation progresses, the pitch or tar is drawn from the bottom of the kiln and the distillate, which consists of an oil and pyroligneous acid, is led into tanks where these products are allowed to separate from one another by gravity. These two products are then further treated and from the oil are obtained pine tar, tar oil, pine oil, turpentine and pine wood naptha. The crude pyroligneous acid yields pyroligneous acid, wood alcohol and acetate of lime.

More than half of the world's supply of naval stores is produced in the United States. France, Russia, Portugal, India, Spain and Mexico also are important producing nations. The United States production of naval stores is largely centered in the pine forests of the South Atlantic and Gulf States and include Georgia, Florida, Alabama, Mississippi, and Louisiana. The production of turpentine in 1941-42 amounted to 548,796 barrels of 50 gallons each. Rosin production in 1941-42 amounted to 2,135,593 barrels of 500 lbs. gross.

Naval stores have a multitude of uses. Among the uses for turpentine are as a thinner for paints and varnishes; as a solvent for resins in lacquer and varnishes, water proofing compounds and rubber. It is used in stains, polishes, pharmaceuticals, enamels, insecticides, mild fumigants, as an ingredient in cements, etc. It is also used in the production of synthetic resins, camphor, terpinine, terpinoline and terpin hydrate.

Rosin is used in laundry soaps and powders; sizing for paper, paperboard, wallboard; in ester gum and other synthetic resins; in paint driers, glass oils, paints, varnishes, lacquers, waxes; as an ingredient in cements, etc.

Turpentine is quoted by the gauge gallon, and the conversion factor used is based upon an assumption that 1 gallon weighs 7.2 pounds. Formerly, rosin was sold in 280-pound units called commercial barrels. The use of this unit, like many other practices in this industry, dates from colonial days when rosin was shipped in rived-stave barrels. The buyer recognized a tare of 20 per cent, or 56 pounds. This left 224 pounds net which was 2 English hundredweights or a tenth of the English long ton. Recently, the unit for rosin quotations has been changed to 100 pounds net, with most rosin now being packed in metal drums having a uniform tare weight.

Gum spirits of turpentine (Savannah) averaged 65 cents per gallon in April, 1942. Gum rosin averaged $2,89 per 100 lbs. in that month. Transportation is in 55 gallon drums. Tank cars and packages of various sizes from 5 gallon drums to quart cans also

are available. Turpentine will keep indefinitely if properly sealed in original containers.

The Federal Naval Stores Act defines and classifies naval stores according to methods of production. These are as follows:

(1) *Gum spirits of turpentine*—The designation "gum spirits of turpentine" shall refer to the kind of spirits of turpentine obtained by distillation of the oleorosin (gum) from living trees, and commonly known prior to the passage of the act as gum spirits, gum turpentine, spirits of turpentine, or oil of turpentine.

(2) *Steam-distilled wood turpentine*—The designation "steam-distilled wood turpentine" shall refer to the kind of spirits of turpentine obtained by steam distillation from the oleoresinous component of wood whether in the presence of the wood or after extraction from the wood, and commonly known prior to the passage of the act as wood turpentine, steam distilled turpentine, steam distilled wood turpentine, or S.D. wood turpentine.

(3) *Destructively distilled wood turpentine*—The designation destructively distilled wood turpentine" shall refer to the kind of spirits of turpentine prepared from the distillate obtained in the destructive distillation (carbonization) of wood, and commonly known prior to the passage of the act as destructively distilled wood turpentine or D.D. wood turpentine.

(4) *Sulphate wood turpentine*—The designation "sulphate wood turpentine" shall refer to the kind of spirits of turpentine prepared from the condensates that are recovered in the sulphate process of cooking wood pulp, and commonly known as sulphate turpentine or sulphate wood turpentine.

Rosin is defined in the Naval Stores Act as follows:

Rosin is the vitreous, well-strained, transparent product, consisting chiefly of noncrystallized resin acids that remain after the removal of the volatile oil from the oleoresinous secretions obtained from species of the family Pinaceae, or that are present in the wood thereof, and contain relatively small proportions of resin esters or other esters, nonacid and noncrystalline resins, or nonresinous foreign matter.

Rosin within the meaning of the act consists of gum rosin or wood rosin.

(a) "Gum rosin" is rosin remaining after the distillation of gum spirits of turpentine from the oleoresin (gum) obtained from living trees.

(b) "Wood rosin" is rosin recovered after the distillation of the volatile oils from the oleoresin within or extracted from pine wood, by any suitable chemical or physical process, followed by any necessary further refinement.

The kind and age of cup, the age of face, care in distillation, and amount of trash in the gum all help to determine the color of rosin. The colors range from a very pale-yellow through shades of amber and brownish red to nearly black. Since color is an important consideration in some of the industrial uses for rosin, color classes or grades have been established and a letter or abbreviation designates each grade. The palest of the American grades is X, with WW, WG, N, M, K, I, H, G, F, E, D, and B following. The last, B, is extremely dark brown-red, nearly black. The first three are symbols for the descriptive names, "extra," "water white," and "window glass," which are used in speaking of these grades. Also, in order to avoid possible misunderstanding of the spoken letters, especially M and N, names beginning with the respective letters have been commonly used for other grades. These are Nancy, Mary, Kate, Isaac, Harry, George, Frank, Edward, Dolly, and Betsy. With the exception of an additional FF grade established solely for wood rosin, the same grades apply to both gum and wood rosins.

The duty is 5% ad Valorum.

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Uranium

A RADIOACTIVE element (U), uranium is a heavy, hard, nickel-white metal. It occurs naturally as an oxide, associated with radium. The melting point of the metal is 1860° F. and its specific gravity 18.68. It is often alloyed with iron to form ferrouranium, usually less than 1 per cent. It is used as a cathode in photoelectric tubes because of its reaction to ultraviolet radiation and, as an oxide, is employed as glazes in the ceramic industry and also for paint pigments.

Although at least one hundred minerals contain uranium, the only important uranium ores have been uraninite, or pitchblende, and carnotite. Pitchblende deposits occur in Saxony and Bohemia and recently have been found in Belgian Congo and Canada. Carnotite comes chiefly from sandstone in western Colorado and eastern Utah. Occasionally uranium bearing minerals are minor byproducts in the mining of feldspar and mica.

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Uraninite

See Uranium

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Urea Resins

See Plastics

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Vanadium

AN IMPORTANT ingredient in the manufacture of hard steel is vanadium, which, while widely distributed, is found in commercial quantities in but a few areas, chiefly Peru, Rhodesia and in the State of Colorado, U. S. A. It is an elementary metal (symbol V), pale gray with a silvery luster; brittle and crystalline in structure. Hydrochloric or dilute sulphuric acid will not attack it and it does not oxidize in air. Its specific gravity is 6.02 and the melting point 3236° F.

World production of the metal has increased markedly in recent years. In 1932 it amounted to 789 short tons (vanadium content) and in 1938 to 2,944 tons. Peru has been the principal Latin-American producer, and in 1938 was the leading world producer. After 1936 production in Peru, Mexico and the United States increased sharply, the 1938 totals being Peru 910 short tons; Mexico 218; United States 806; South-West Africa 615; Northern Rhodesia 412 tons. Shipments are usually in the form of concentrates rather than raw ore and generally contain from 8 to 15 percent vanadium.

The United States is the world's largest consumer of vanadium, utilizing not only all of its own production but also a substantial quantity of imported metal. Imports in 1939, amounted to 1,066 tons (vanadium content) and to 1,287 tons in 1940. All United States imports are from Peru. In 1940, imports were valued at $1,217,000, or at the rate of $945 per ton. The mining of vanadium ore in the United States was virtually abandoned when the exploitation of the Peruvian deposit was undertaken and it was not until 1936, when new equipment was installed in United States mines, that domestic production began to supply any considerable portion of the rising United States demand. Domestic production which averaged 472.5 tons (vanadium content) for the 1936-38 period, rose to 995.9 short tons in 1939 when imports were 1,066 tons against the average of 497.5 for the 1936-38 period. Imports of vanadium ore enter the United States free of duty, whereas metals and alloys containing vanadium are dutiable, in most instances at 25 percent ad valorem plus $1 per pound on the vanadium content. Colorado and Utah vanadium comes from carnotite while the Arizona ore is vanadinite.

The principal use of the metal is for control of grain growth and toughening steel. For

this, it is added to molten steel in the form of ferrovanadium. The only other important use is as a catalyst in the manufacture of sulphuric acid. It dissolves with a blue color in solutions of nitric acid and readily alloys with iron. As a coloring material for pottery and glass and as mordants in dyeing, vanadium salts are used while vanadium oxide, a reddish-brown material is used as a catalyst and for making compounds. The oxide is also used for producing yellow glass. In steel, it is usually employed in amounts, from 0.05 to 0.20 percent. Its uses were first developed in the United States and were later applied in European countries.

Vanadium is indispensable in all high speed tool steels. In the well-known molybdenum high speed steels, vanadium is essential to stabilize carbides and inhibit grain growth at heat treatment temperatures. Vanadium is actually more complementary to molybdenum than competitive. Molybdenum produces deep hardening while vanadium on the other hand tends to produce fine grain size which toughens hard steels.

While quoted prices for vanadium ore averaged about 26 to 28¢ per pound of vanadium content for a long period, these quotations were mostly nominal as most of the ore is processed by producing companies. Ferrovanadium, has held fairly constant in price, averaging, from 1933 through 1939, about $2.80 per pound of the contained metal. The Mexican output, formerly consumed in Europe, will be absorbed by the United States, and the United States needs can probably be met by increased domestic production and by increased imports from Peru and Mexico. Vanadium was one of the first commodities to be placed under a General Preference Order (M-23) August 16, 1941, and on December 20, 1941, an amended order (M-23a), directed no person to make or accept delivery of vanadium (including ferrovanadium, etc.) unless specifically authorized by the Director of Priorities. It is also covered by General Imports Order M-63. Form PD-84 must be filed with the Vanadium Branch of the War Production Board, Washington, D. C. by all persons requesting delivery of vanadium.

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Vanadium Oxide

See Vanadium

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Vanadium Salts

See Vanadium

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Vanilla Beans

See Vanillin

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Vanillin

VANILLIN is the active constituent of vanilla beans and is the material responsible for the fragrant odor and pleasing taste associated with them. It occurs as white crystalline needles. Commercially, vanillin is produced by three processes: oxidizing isoeugenol, which is obtained from the oil of cloves; from guaiacol by a condensation process; and by the treatment of the lignin waste material of the paper-pulp industry. The lignin process vanillin was first offered in 1938 and now dominates the market.

The production of guaiacol vanillin, the only process on which data is available, indicates that in 1940 some 576,708 pounds were made, and in 1939 some 608,614 pounds manufactured. The market packages of vanillin include tins containing 400, 160, 80, 16, and one ounce of the material; and bottles containing one ounce and one pound.

The principal use of vanillin is as a flavoring material in foodstuffs, tobaccos, and other products. It enjoys an especially large volume since it is employed to add body to other

flavors, such as chocolate, in addition to being a flavor in its own right. Perfume compounds also employ vanillin. The price of vanillin during the first half of 1942 ranged from $2.35 to $2.60 per pound, according to source. Lignin and guaiscol vanillin being the less expensive. At the start of 1941 the lignin and guaiacol varieties were quoted at $2.50 per pound and the eugenol type at $2.60 per pound.

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Veal

See Meat

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Vegetable Spermaceti

See Chinese Insect Wax

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Vermiculite

A FOLIATED mineral which occurs in crystalline plates of considerable size, vermiculite has been produced in increasing quantities in the United States, principally at Libby, Montana but also on an increasing scale in North Carolina and to a limited extent in Colorado and Wyoming. It is yellowish to brown in color with a specific gravity of 2.3 and a hardness of 1.5. It is a hydrous silicate, an alteration of certain types of micaceous minerals. It has the property of expanding when calcinated at 1750° F. to as much as 16 times its original size, into a fluffy mass, at right angles to the cleavage—changing in color to a silvery or golden hue.

In plaster, vermiculite "small-size" pellets replace fiber, and part of the sand and the product has good heat—and sound—insulating properties. The first resistance of such plaster is superior to that of others from larger pellets of vermiculite which sometimes expand further when strongly heated, thereby causing cracks. Until recently, sizes smaller than those used for loose hold fill (minus 3- plus 14-mesh) have been difficult to dispose of but recent new uses in conjunction with fireclay and bentonite for special refractories have been developed. Refinements in exfoliation have taken place and it is claimed that it can be used in the inner soles of shoes and in making insulating brick. The use of vermiculite in light-weight concrete has reached a point where one producer is experimenting with a pre-cast vermiculite-concrete house.

Vermiculite sparkled in the walls of the San Francisco World Fair as a result of its use (140 tons) in 200,000 square yards of exterior concrete. It was especially heat-treated to a bright golden yellow and applied while the cement stucco was still wet. However, the decline in the use of mineral wool for home insulation has hurt demand somewhat. Nevertheless, in 1940, sales of vermiculite in the United States increased to 22,209 tons valued at $148,723 compared with 21,174 tons worth $174,587 in 1939. A good deal of the vermiculite is marketed under trade names. Sound-absorbing building tiles; corklike pellets, called Mica pellets for house fill; and a fine-mesh product used as an extender in aluminum paint and heavy lubricating oils—are some of the end uses. It is claimed that plaster consisting of 60 percent vermiculite, 30 percent plaster of paris and 10 percent asbestos will withstand red heat without disintegrating.

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Vetiver Oil

VETIVER OIL is a thick, yellow liquid obtained by the distillation of the roots of Vetiveria zizamoides, a perennial tufted grass which grows wild in various parts of India. The plant is also cultivated in Reunion, Java, the Malaya Peninsula, and the Philippine Islands. The vetiver grass is sometimes known

as khushkus, or cuscus, and the oil occasionally is referred to by those names also.

Imports of vetiver oil in 1940 were 28,892 pounds, valued at $77,957. The leading suppliers were the Dutch Indies, with 22,598 pounds, and the French African colonies with 4,310 pounds. In 1939 the imports were 18,206 pounds, valued at $49,127. Netherlands Indies in that year supplied 12,057 pounds and the French African colonies 4,267 pounds. Commercially the Java oil is packed in 25-pound tins and the Reunion oil in one-pound bottles.

Vetiver oil is an important fixative in the perfume industry. The Java oil on June 1, 1942 was priced at about $45.00 per pound. On January 1, 1942 its price was $28.44 per pound. On January 1, 1941 the quotation was $6.00.

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Vinylidene Chloride Resins

See Plastics

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Virginia Pine

See Southern Pine

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Volatile Oils

See Essential Oils

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Walnut

The fruit or nut of the walnut tree, produced from cultivated orchards.

In the United States, about 92% of the nation's output comes from California and 8% from Oregon and Washington. The main foreign sources of supply prior to the war were France, Italy, Balkans and Manchuria. Domestic production approximates 100 million pounds annually (in-shell, orchard run). Foreign production is considerably larger but reliable statistics have been lacking recently. Walnut production was in no way curtailed by the war. The only problems were those which concerned packing house equipment and processing materials, supplies of containers, etc.

About 60% of the walnut crop is sold in the shell. The balance is shelled and sold as shelled walnuts. Walnuts are used primarily as a food for eating out of hand or in cooking. Shelled walnuts are used extensively by bakers, manufacturers of candy and ice cream. Towards the middle of 1942 consumption of shelled walnuts tended to slow down somewhat, due to threatened sugar shortages among manufacturers of candy, bakery goods, etc.

In-shell walnuts are marketed in 100 lb. bags. Shelled walnuts are sold in 25 lb. cartons and in 5 lb. cartons packed 6 per case. The price per lb, in-shell, averaged about 17½ cents to the wholesalers early in 1942 or about 2¢ higher than comparative 1941 levels. Shelled walnuts averaged about 40¢ per lb.

In-shell walnuts are packed in bags while shelled are shipped in cartons. They are semi-perishable and require cold storage in summer.

In-shell walnuts are classified in 3 grades for kernel and cracking quality and 3 for size. Shelled walnuts have 3 grades for kernel color and 3 grades for kernel sizes. Price differentials are essentially constant.

Substitutes consist of other nuts such as pecans, brazils, etc., which are also the principal competing articles. The duty is 5 cents per pound on in-shell and 15 cents for shelled.

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Washing Soda

See Soda Ash

Wattle Bark

DERIVED from various African and Australian acacias, the astringent bark is used by tanners in the manufacture of leather. Most of the United States supply comes from South and East Africa. Exact import statistics are not available but the United States in 1940 imported 131 million pounds of "Extracts for dyeing and tanning," valued at $4,602,000.

Delivery is in chopped form as small pieces of thin bark of a reddish-tan color. It is sold by the ton, in bales. Prices were nominal in early 1942 due to the uncertainty of ports of delivery. While there are a variety of grades, the principal ones marketed in the United States are either South or East African, merchantable grade, chopped. The commodity will keep indefinitely if protected from moisture and enters the United States free of duty.

The bark falls under the general classification of a tannin—or a substance for treatment of skins and hides to make them resistant to decay. It belongs in the catechol color class, giving a bluish violet precipitate with ferric salts.

Artificial tannin, some mineral tanning agents, and other vegetable tannins, can be substituted. Increased demand for leather for war purposes has expanded the demand for all tannins while at the same time the war has interfered with deliveries from the sources of supply.

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Waxes

THE true waxes are materials of vegetable or animal origin, and chemically are esters of high-molecular weight monohydric alcohols and high-molecular weight fatty acids. In this they differ from the fats and oils, which are esters of the trihydric alcohol, glycerine. Physically the waxes are harder, more brittle, and less greasy than the fats. The "mineral" waxes, are in reality hydrocarbon compounds, and include such materials as ceresin, montan wax, ozokerite, and paraffin. The prices shown for the waxes are those in effect in the New York resale trade. It must also be noted that waxes such as Montan, Ozokerite, Ceresines and Japan Wax can no longer be imported because of the war, hence the void is being taken up with substitutes.

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Whale Oil

THIS oil is obtained from the blubber of whales. The blubber is stripped clean from the flesh of the whale, cut into strips and then further reduced in chopping machines. Then it is placed in large pans and boiled. The first run of oil is called "Whale Oil No. O." Its color ranges from pale yellow almost to water-white. The mass of blubber is boiled further and the next run of oil, colored slightly darker, is termed Whale Oil No. 1. Added treatment yields Whale Oil No. 3 and No. 4; in some instances the bones are treated to yield Whale Bone Oil.

Domestic production is confined largely to shore station operations on the West Coast and in Alaska. In the decade prior to the war (1930-39) domestic production, including sperm whale oil, averaged about 23 million pounds annually. Imports, mostly from Norway, averaged about 33 million pounds.

The principal uses for whale oil in the United States is in soap manufacture. In Europe, it also serves as a food.

There is a 3 cent excise tax on imports of whale oil.

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Wheat

NO ONE knows how long wheat has been cultivated for human food. Archeologists have found traces of its use as long as six thousand years ago. Yet it was intro-

duced into the western hemisphere only in 1530 by the Spaniards. ' They first cultivated it in Mexico and Spanish wheat was brought to California shortly before the American Revolution. Wheat farming was introduced on the Atlantic coast by the first colonists from Europe.

As the country grew, wheat cultivation moved steadily westward and now the bulk of the nation's annual harvest comes from the mid-western states. Most of the varieties known to the early settlers have long since disappeared, replaced by new and improved types.

Wheat grown in the United States must be divided, for purposes of classification, into two main groups, "Winter wheat" and "Spring wheat," even though there are more than 300 known varieties. By far the most important of the two groups, from the production volume standpoint, is the winter wheat, which accounts for from 70 to 80 percent of the annual total crop.

Many types of winter wheat must go through a dormant period to be productive. These are planted in the Fall, lie dormant in the Winter, and are harvested late in the following Spring and early Summer. Spring wheat is planted in the Spring and harvested in the following Summer. A number of varieties can be planted in either the Fall or the Spring.

The most important producing nations are Russia, the United States, Canada, Argentina, Australia, and the countries of the Danube Basin. In the United States, the leading winter wheat producing states are Kansas, Oklahoma, Nebraska, Ohio, Illinois, Texas, Indiana, and Washington. The main Spring Wheat states are North Dakota, Montana, Minnesota, South Dakota and Washington. World production, exclusive of Russia and China, ranges from 4 to 4½ billion bushels annually. Production in the United States averages about 800 million bushels annually.

Under Federal official grain standards, wheat comes under five main classes: (1) Hard Red Spring (2) Durum (3) Hard Red Winter (4) Soft Red Winter and (5) White. The Federal standards also provide for a class known as Mixed.

Hard Red Spring wheat is grown mainly in the Dakotas, Montana, Minnesota and Wisconsin, where the winters are too harsh to permit production of Winter Wheat. This type usually accounts for approximately 20% of the total acreage sown to wheat in the United States. It is used mainly in the production of bread flour. Prior to the present decade most of the Hard Red Spring Wheat grown in this country was of the Marquis variety. In many areas this was replaced by the Ceres variety because of rust-resistant qualities at the time of its release. In recent years Ceres has been severely injured by the rusts and both Marquis and Ceres have been replaced, largely by Thatcher. This variety is now grown on more than 17,000,000 acres in the Hard Red Spring wheat area.

Thatcher is resistant to stem rust but susceptible to leaf rust. Several new varieties have been released during the past three years which are resistant to both rusts. These varieties, Rival, Pilot, Renown and Regent are replacing Thatcher in areas where leaf rust is a factor in the growing of Hard Red Spring wheat.

Durum wheat is used in the production of macaroni and other alimentary pastes. It contains a higher proportion of protein than any other wheat but makes an unsatisfactory loaf of bread. It is unpopular for bread flour uses. Most of the Durum wheat grown in this country is produced in the Dakotas with Minnesota contributing in a small way. The chief varieties of Durum wheat are Kubanka, Mindum and Pentad or D5. The Pentad variety is not so much in favor with the macaroni manufacturer owing to the dark color which it gives to his product. The Federal standards set up a new classification for

this variety known as Red Durum. Durum wheat accounts for about 5% of the nation's wheat acreage.

Hard Red Winter wheat leads in importance, usually accounting for about 45% of the domestic acreage sown to wheat. It is grown in the Western two-thirds of Kansas, and adjoining areas of Nebraska, Oklahoma and the Texas Panhandle. Hard Red Winter Wheat also is produced in Illinois, Indiana, Iowa, Minnesota, Montana, Idaho, Washington, Oregon and Utah. About 95% of the production consists of the Blackhull, Turkey, Kanred, Nebraska 60 and Tenmarq varieties. Hard Red Winter Wheat is used in the production of bread flour.

Soft Red Wheat, accounting for about a third of the nation's output, grows in central Texas, eastern Kansas, Missouri, the southern half of Illinois, Indiana, Ohio and the central Atlantic Coast states and parts of the Pacific Northwest. The most important varieties of Soft Red Winter Wheat are Trumbull, Fultz and Fulcaster. This type of wheat is best suited for biscuits, fine cake and pastry flours.

White Wheat accounts for between 5 and 10% of the wheat acreage in the United States. It is grown mainly in California, Oregon, Idaho and Washington. It produces cracker and pastry flours, cereal products and poultry feeds.

When wheat is mixed, its utility may be impaired but often mixtures are unavoidable. For example, if the crop is killed during the winter, it is common in some areas to re-plant with spring wheat and both kinds are harvested together. Where different wheat belts border, mixtures may occur in the field or various lots may get mixed in marketing.

During 1942, the Federal Government actively encouraged a wider use of wheat as a feed for livestock and in the production of alcohol.

The marketing unit is the bushel weighing 60 lbs. The crop season begins July 1st and ends June 30th of the following year. Government loans exert an important influence on price. During the 1942-43 season, the loan rate will average $1.15 per bushel on the farm (equivalent to about $1.32 per bushel in Chicago). However, prices tend to fluctuate above and below the loan level. Transportation is by truck, rail and boat.

The chief substitutes for wheat are rye and corn. In some countries, the potato and its products are used partially to fill the place of wheat.

The duty on wheat is 42¢ per bushel. Imports are regulated by quotas.

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Wheat Flour

WHEAT FLOUR is the product to which the unqualified term "flour" is always applied, and possesses peculiar properties that make it especially desirable in bread making. These properties together produce a tough but elastic dough, which after permeation with gas, due to yeast fermentation or other gas-producing agencies, and subsequent baking forms an exceedingly light and porous food, easily digested, and possessing all the useful nutritive properties. The nitrogenous constituents of the flour yield, when mixed with water, the gluten, possessing the elasticity and tenacity essential in bread dough. The flour of most other cereals, when used for bread, is mixed with wheat flour.

But of all the cereal grains only wheat contains the kind of proteins which enable the flour from it to produce a smooth, satiny dough. Of the several proteins that wheat flour contains, the chief ones are gliadin and glutenin. When wheat flour is moistened, the gliadin and glutenin combine to form the substance we call gluten. Gluten makes the framework of bread, biscuits, cakes, and most other baked products. Bread flour yields more gluten than cake

flour. Moreover, strands of gluten from bread flour are more elastic, thicker, and less tender than those from cake flour. The gluten from soft wheat all-purpose flour is more delicate and less tenacious than that from hard wheat all-purpose flour.

Modern flour milling is a gradual reduction process which aims not to produce as much flour as possible at a single grinding, but by repeated grindings or "breaks" to separate the outer bran from the inner grain, then to purify the latter gradually into "middlings," and from these "middlings" by further fine reduction to obtain a pure fine flour.

First crushing is through two pairs of chilled iron rollers about nine to ten inches in diameter and 24″ to 34″ long, with surfaces cut or grooved at an angle and with different speeds, so that the grain is not powdered but merely cracked or crushed. The outer bran coat flakes off and the endosperm is broken into large particles which come fairly clean from out the bran. The product is called the "first break."

This "first break" is then sieved into bran, middlings (mixed endosperm and finely broken bran), flour, and unbroken wheat. The latter is of course rerun through rollers until it becomes bran, middlings, and flour.

The flour produced by these rollings is usually called "red dog," and forms the lower or cheaper grades of flour, being more or less mixed with bran and other portions of the husk. The bran is of course sieved out, together with the oily germ of the grain.

When these by-products are gone, there remain the more or less finely ground middlings practically free from the outer layers. These are the makings of "patent flour," the finest and most expensive product of the mill. The middlings are then ground between smooth iron reduction rollers which powders them so that a substantial fraction will bolt through silk bolting cloth.

A "long patent" flour, such as an "80 percent patent" is one in which the refining has been so thorough that 80 percent of the total flour recovery from the grain has been carried through to the final product and only 20 percent left in the second-grade flours obtained from the intermediate breaks and reductions. Wheat usually yields about 70 percent flour and 30 percent feedstuff, i.e., bran and shorts. This 70 percent of flour goes on the average about 80 percent into "patents," 15 percent into "first clear," 5 percent into "second clear" and "red dog," depending on how the miller sets his machinery and the trade to which he caters.

Second clear flour is a lower grade floury product containing more than 1% ash, and under the official definition cannot be called flour, but must be branded "second clear flour" to make plain its inferiority to white flour.

The leading flour producing states are Kansas, Minnesota, New York, Missouri, Texas, Illinois, Washington, Oklahoma, Ohio and Nebraska. U. S. production ranges from 100 to 105 million barrels annually.

Gluten flours are high protein flours from which much of the starch has been removed. Graham, whole wheat, entire wheat, crushed wheat and cracked wheat flours are ground products containing 100% of the wheat berry.

Phosphated flour is wheat flour to which a small amount of mono-calcium phosphate has been added. Self-rising flour is flour to which mono-calcium phosphate, bicarbonate of soda, and salt have been added to facilitate baking. Phosphated flour, self-rising flour, and soft wheat flour are used chiefly in the Southern States.

Semolina is used in the manufacture of macaroni, spaghetti and related products. Granular and amber in color, they are made from hard, high protein amber durum wheats, coarsely ground and carefully purified.

Bread flours are milled primarily for commercial and home bakers from blends of hard spring or hard winter wheats, or blends

of these. They are fairly high in protein and slightly granular to the touch; they may be bleached or unbleached.

All-purpose or family flours, made for general household cookery purposes, are lower in protein content than bread flours, but contain enough gluten for making good yeast breads, yet not too much for good quick breads and cakes.

Pastry flours are finely milled from soft wheats, though they are not so fine as cake flour; low in protein content, they are used chiefly by bakers.

Cake flours are likewise milled from soft wheats. They are short patents, representing the most highly refined flour streams of the mill. Their granulation is uniform and very fine; their protein content low.

Transportation is by rail and boat. There are a number of substitutes.

Rye flour is milled almost as wheat, and blends with wheat flour for a palatable and wholesome bread. Corn flour is prepared by pulverizing the corn grits which correspond to the middlings of wheat flour milling. Rice flour is used extensively in Britain and Germany. Flour substitutes have been prepared from the banana, cassava, dasheen, sweet potato, soy bean, and peanut, and can all be used with wheat flour in the proportion of about one to three. Oats are seldom ground to flour but rolled oats may be used with wheat flour to make raised bread.

The import duty on wheat flour is 1.04 cents a lb.

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Whiskey

See Distilled Spirits

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White Fir

See Spruce

Whitefish

One of the most important of the fish taken from the Great Lakes is the whitefish, Coregonus clupeaformis, (Mitchell). Members of the whitefish family include the common whitefish, menominees, lake herring, cisco, and chub. The whitefish family have ranked first in production and in value of all the Great Lakes fisheries but depletion has thinned their ranks until today the catch has dropped considerably.

The most important of the coregonid fishes, famed for its delicate flavor and the quality of its flesh, is the common whitefish. This specie is still commercially important although catches have dropped considerably in the past few years.

During 1940 whitefish production amounted to 4,678,000 pounds with a value of $738,000. The menominees amounted to 101,000 pounds with a value of $7,000. Of this amount the Great Lakes accounted for all of the menominees catch and 4,618,000 pounds valued at $735,000 of the common whitefish catch. The only other area to report any substantial commercial quantities was the Pacific Coast with 60,000 pounds valued at $3,000.

During 1939 the production of common whitefish amounted to 4,025,000 pounds valued at $722,000 which indicates a slight rise in production and values for 1940. The menominees amounted to 138,000 pounds valued at $14,000, a distinct drop in the catch for 1940 and a very substantial drop in the value.

Standard whitefish sizes and grades, as recognized by Chicago dealers are. heads on, eviscerated; No. 1-1½ to 3 pounds; Medium jumbo, 3 to 4 pounds; Jumbo, 4 pounds up. Few whitefish today will weigh over 6 pounds.

Most of the whitefish are shipped out by express and truck in 50 and 100 pound wooden boxes. This also holds true of the

whitefish produced on the Canadian side of the Lakes and shipped into the United States.

A very small percentage of the catch is smoked but most of it is marketed fresh, heads on, eviscerated.

This species is characterized by an oblong, compressed body of a distinctive white coloration, sometimes dusk or yellowish-bronze above. The head is small and short with a blunt snout, and the lower jaw is somewhat shorter than the upper. The dorsal fin is of moderate size, the tail fin is deeply forked, and an adipose fin is present, indicating the relationship of the whitefish to the salmon and trout families.

Whitefish do not appear in the commercial catch until they are at least six or seven years old. They live in waters 180 feet deep or less, coming to more shallow waters to spawn. The number of eggs deposited by the female in spawning depends upon the size of the fish. It is estimated that 10,000 eggs are laid for every pound of fish. The eggs require about five months for development.

The whitefish is commercially caught in trap nets, gill nets, and pound nets. This fishery is now restricted to certain localities of the Lakes only, due to the rapid depletion that has resulted from overfishing. It is still caught in fair quantities, however, and is very much in demand by the consuming public.

Whitefish are caught the year around with the best catches recorded during the fall of the year and late spring.

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Wintergreen Oil

WINTERGREEN, or wintergreen-leaf oil is distilled from the leaves of Gaultheria procumbens, an evergreen herb which grows abundantly in the wooded mountain areas of the middle Atlantic States and the south Appalachians. The colorless, yellowish, or reddish oil is official in the United States Pharmacopeia as Methyl Salicylate. The standard specifies that the oil contain not less than 98 percent of the ester methyl salicylate.

Synthetic wintergreen oil, the ester of methyl salicylate, has far outstripped the natural material in the commercial market. The ester is produced by the reaction of methanol and salicylic acid. In 1940, production of methyl salicylate in the United States amounted to 1,641,571 pounds. In 1939 the total was 1,684,619 pounds. Commercially, natural wintergreen oil is offered in a northern and a southern variety. Both are packed in 25-pound tins. The northern oil is slightly higher in price. Synthetic methyl salicylate is packed in 500-pound drums and 50-pound tins.

Methyl salicylate is employed as an odorant, in medicine and especially for flavoring. Wintergreen oil on June 1, 1942 was priced at $4.75 for the northern grade, and $3.50 for the southern grade. On January 1, 1942 the same prices were in effect. On January 1, 1941, however, the northern oil was $4.35 per pound and the southern oil $3.05 per pound. The price of methyl salicylate on June 1, 1942 was 35¢ per pound.

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Witherite

See Barite

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Wolframite

See Tungsten

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Wood Alcohol

See Turpentine and Rosin

Wood Oil

See Tung Oil

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Wood Pulp

See Paper

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Wool

ORIGINALLY, sheep were kept for milk and flesh, while the skins were used for clothing, covering at night, and possibly for tents. Spinning and weaving of the fleece were developed only as Man abandoned his nomadic mode of life; in fact, weaving of grasses, leaves, and the bark of trees into matting for huts and coverings is still practiced by primitive peoples to whom the spinning of wool is unknown, indicating that the art of weaving is older than that of spinning.

Two principal methods are used in the herding of sheep in the United States. In the important wool growing areas, Texas, the Rocky Mountain and West Coast states, the sheep are herded on the open range with perhaps the lee of a hill for shelter. The other method is in pasture with perhaps a barn for protection.

Wool, when clipped, is called "grease wool." Hand clippers, not unlike a barber's, are often used. However, for large herds, power driven clippers are used. A small percentage of the country's production (about 20 to 25% scoured equivalent) is in the form of "pulled wool," the wool from slaughtered sheep.

When the wool is shorn from the sheep it contains much grease, dirt, and foreign matter, which must be removed by scouring. The grease is sometimes recovered as lanolin. After the scouring process, the wool is referred to as "scoured wool."

Domestic shorn wool becomes available in quantity on the Boston market during May and receipts reach a peak during July. Shearing usually starts in February and March in Arizona, California, and Nevada —a month later in the territory and fleece wool States—and extends through July. Most sheep are shorn only once a year, but in Texas and California some are shorn twice a year.

In Australia, the shearing season extends from July through November, with central market receipts reaching a maximum in October. In Argentina, shearing is heaviest from October through December, with receipts heaviest in November. Pulled wool production is heaviest during the winter months, but seasonal factors are not important.

The most important wool producing areas are Australia, South Africa, New Zealand, the U. S. A., Argentina and Uruguay. World production approximates $3\frac{1}{2}$ billion pounds annually of which the U. S. A. produces about 400 million pounds.

The value and use to which the wool will be put is largely determined by the length and fineness (diameter) of the fibres. The main classifications are as follows:

(1) APPAREL CLASS: This includes wool particularly suitable for and chiefly used in apparel of one sort or another, but also finds use in numerous other items, such as blankets, upholstery, carpets and rugs, felts and industrial fabrics.

(a) *Combing, or worsted:* This class is most valuable. Length of staple is required and this wool is used chiefly for the manufacture of worsted yarns.

(b) *Carding, or clothing:* This class has felting qualities and is mostly used in woolen yarns.

(2) CARPET CLASS: This includes wool particularly suitable for and chiefly used in carpets and rugs, although sometimes used in other products.

The marketing unit of wool is the pound. The central wool markets, which handle

some three-fourths of the annual clip and much of the imported apparel wool, are principally Boston and Philadelphia. Some wool is also sold through St. Louis and Chicago. At present Boston has superseded London as the world's greatest wool market. It will be noted that the central markets are located near the large wool manufacturing centers. The Boston market is located near the New England mills which produce roughly two-thirds of the nation's output of wool goods.

Wool is non-perishable but is susceptible to moths.

Wool may be broadly classed as either apparel or carpet wool. Apparel wool is divided by grades, according to two systems, the blood system and the count system. The count system originally referred to the count of the yarn that could be spun from the wool—the highest count yarn being spun from the finest grade wool. The blood system originally indicated the proportion of merino blood in the sheep from which the wool was shorn. Neither system now has any significance except as a commonly used designation of the fineness of wool. A comparison of the domestic blood and count system is given below:

Blood System	*Count System*
Fine	64s-70s-80s
½-blood	58s-60s
⅜-blood	56s
¼-blood	48s-50s
Low ¼-blood	46s
Common and Braid	36s-40s-44s

Argentine wools are graded from 56s down as BA-1's, BA-2's, down to BA-6's for coarse wools. Uruguayan wools are graded in the same way except that they are designated as Montevideo 1's, 2's, etc. Australasian wools are classed broadly as merino and crossbred, with many sub-grades under each classification. South African wools are mostly all fine merinos. Bradford topmakers' counts, used in the London wool market, run somewhat higher than the American count system. For example, a domestic 56's would approximate a Bradford 58/60s. The terms "Merino," "crossbred" and "low crossbred" used in the world wool trade designate, in the first case, fine and ½-blood wools, while crossbred refers to wools produced by sheep whose blood is not wholly or principally merino.

The main substitutes for wool are cotton, rayon and lanital. The duty on wool is as follows:

34¢ per lb. of clean content finer than 44's quality.

17¢ per lb. of clean content not finer than 44's quality.

13¢ per lb. of clean content not finer than 40's quality.

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Wormseed Oil

WORMSEED, or chenopodium oil is a colorless to yellowish liquid distilled in this country from the leaves and seeds of Chenopodium ambrosiodes. A wormseed oil produced in the Levant is obtained by distilling the unexpanded flower of Artemisia maritima. The American oil is official in the United States Pharmacopeia. Commercially wormseed oil is packaged in 28-pound tins. On June 1, 1942, the oil was quoted at approximately $3.00 per pound. At the beginning of the year its price was at the same level, while at the start of 1941 the quotation was slightly higher.

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Yellow Fir

See Douglas Fir

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Yellow Poplar

See Hardwoods

Yellowtail

See Tuna

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Yttrium

See Monazite

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Zinc

ZINC is a bluish-white metal, (Zn) with a specific gravity of 7.142. It is obtained chiefly from the minerals sphalerite and calamine. The melting point is 787° F. and it will boil at approximately 1700° F. At about 250° it can be rolled into thin sheets. It casts easily and will resist atmospheric corrosion after becoming coated with a carbonate on the initial exposure to the air. It has a crystalline structure when broken. In impure forms of slab zinc, it is often called spelter.

The United States is the world's largest producer and consumer of zinc, which enters this country over a tariff of 1.40¢ a pound, reduced by a reciprocal trade agreement with Canada from 1.75¢. Chief use is for galvanizing (zinc coating) steel, which takes 40% of domestic consumption. The largest normal ultimate market is on the farm, where galvanized sheets and wire must meet outdoor requirements. Brass production takes 28% and varies with the activity of the construction electrical industries. Use of zinc in die castings has grown fast in recent years, and in the form of zinc alloys finds an expanding outlet in this field.

Important American ore sources in the East are in New Jersey, New York, Virginia and Tennessee, but the "Tri-State" region in the corner of Missouri, Kansas, and Oklahoma, is the nation's principal ore source. During the World War extraordinarily large deposits were found in the western end of this field and Oklahoma became the leading zinc producing state.

In the Tri-State region, as in most zinc fields, zinc and lead are closely associated in the ores. The deposits are generally horizontal, at from 150 to 350 feet down, and are mined in open stopes with the roofs supported by "pillars" of ore or other material. The blasted ore is hauled by hand or mule to the shaft and hoisted to the surface and crushed and ground in the mill to separate the zinc and lead minerals from the waste flint rock.

Tri-State ores yield about one part lead to six of zinc and together these are about 5% of the ore's weight. The zinc concentrate, however, is about 60% metallic zinc. In the smelting, about two tons of this concentrate are required to produce a ton of slab zinc.

The Tri-State concentrates go to smelters in the coal fields east of the Mississippi and to the natural gas fields of Oklahoma, Arkansas and Texas. Western ore-bodies usually are deeper and cost more to mine than Tri-State ores. Through the development of the selective flotation process not only was the zinc in many western mines changed from a waste product to a by-product but many ore-bodies were made commercially worth digging. And with this came rapid growth of electrolytic refining, giving a powerful impetus to western slab zinc production.

Slab zinc is sold on standard specifications which have been adopted by the American Society for Testing Materials and by industry generally.

Principal grades and maximum impurities allowed are Special high grade, lead .007%, iron .005, cadium .005, sum of all three .01%; high grade, .07, .02, .07, .10%; intermediate, .20, .03, .50, .50%; brass special .60, .03, .50, 1.0%; selected .80, .04, .75, 1.25%; prime western 1.6, .08.

As a matter of convenience to both buyer and seller, prices are generally quoted in

cents per pound at East St. Louis, regardless of the point of production. The buyer's cost is consequently the quoted price at East St. Louis plus the established freight rate from that point to destination.

The market for zinc is an international one. Normally the price outside of the United States is quoted on a London basis, where trading in zinc on the metal exchange is active and prices constantly fluctuate. (With the outbreak of the war, London Metal Exchange operations in zinc ceased on August 31, 1939, and normal trading ended as the British Government initiated control of prices and supplies.) It is, therefore, a great convenience for both buyers and sellers in the United States to have one base price upon which to make comparisons. The system of quoting prices on an East St. Louis Basis developed naturally not only because of its convenience to the buyers and sellers of slab zinc, but because it is a basis upon which buyers and sellers of ore may transact business with a specific relationship to the price of the metal itself. Small producers of ore frequently sell their output on the basis of a future East St. Louis price or upon an average of such price over a period of time.

The East St. Louis price, which is widely published, is the price for Prime Western zinc, the type of metal most generally used in galvanizing. High Grade zinc is sold at a premium over and above the price of Prime Western, but on a delivered basis. The other grades such as Brass Special, Selected and Intermediate, are sold at smaller premiums above the Prime Western grade.

Sulphuric acid is the main by-product of the zinc industry. This is obtained from the sulphur gases evolved in roasting the zinc concentrates. Most of the acid thus produced is sold to chemical manufacturers and oil refineries.

Other by-products include certain metals which occur with zinc in the ore-bodies and which are not entirely separated in the concentration process. These include lead, silver, gold and copper, also cadmium for which there is an increasing demand as a bearing metal and for surface finishes and plating.

Secondary zinc is recovered from scrap material of various kinds, including brass and other alloys. The statistics covering this phase of the industry are not considered complete, but the best available indicate that in recent years the recovery of secondary zinc in the United States has equalled from 18 to 20 per cent of the total zinc production. In addition, a considerable quantity of byproducts are made from zinc dross skimmings and ashes, the waste product from galvanizing operations.

About a sixth of our zinc in peacetime goes directly into zinc compounds such as zinc oxide, lithopone, and various zinc salts.

Many modern paints owe their superior whiteness, hiding power, and other valuable properties to zinc pigments. Zinc oxide is also needed in making rubber tires, and zinc pigments in oil cloth, linoleum, tile, glass, etc. Rolled zinc is used for roofing, dry batteries, etc. Zinc die-castings are making possible low-cost production of metal parts of an almost infinite variety.

In galvanizing, zinc has unusual qualities as a protective coating. Molten zinc readily "wets" iron or steel, forming a continuous metallic coating free from "pin holes" and bonded to the base metal by an actual iron-zinc alloy at the contact surface. It also affords electro-chemical protection to iron or steel; by the sacrificial action of zinc when the two metals are in contact.

Most galvanizing or zinc-coating is by hot-dipping. The durability of galvanized materials depends directly on the thickness of the zinc coating and informed buyers so specify. Most galvanized wire is coated before weaving, the coat being light to avoid being broken in bending. "Chain - link" fencings and much poultry network, how-

ever, are galvanized after weaving, and much more heavily.

Rolled zinc goes into fruit-jar covers, wash-boards, table-tops, ice-box linings, weather stripping, dry battery cases; the plate under the old family stove was usually rolled zinc; automobiles use large tonnages, usually plated with nickel or chromium, and in the building fields much goes into roofing and siding, flashings, gutters and down-spouts.

Zinc alloy die-castings, which necessitated the development of high grade zinc testing over 99.99%, are made by forcing the molten metal under pressure into steel dies, where it instantly solidifies in the exact form or shape desired, sharp and clean-cut.

Under stimulation of war requirements, smelter production of slab zinc from both foreign and domestic ores in 1941 exceeded the previous record of 1940 by 22%. Demand for zinc was the heaviest on record, necessitating restriction of civilian uses. Smelting capacity was expanded during the year and although there was a slight gain in producers' stocks, consumers' stocks of slab zinc decreased about 10 percent. The average quoted price of slab zinc at St. Louis in 1941 was 7.47¢ per pound compared with 6.34¢ in 1940. In an effort to expand output from marginal producers and increase the domestic supply, the price was raised in October, 1941, from 7.25¢ to 8.25¢ where it was holding in mid-1942.

Demand expanded, especially for the high-grade varieties. To maintain capacity operations, smelters in 1940 turned to foreign ores which were available in substantial tonnage because the British Blockade prevented their shipment to continental European smelters and these imports have continued to grow.

The war production program has restricted the use of zinc for most civilian purposes. The first zinc restriction order, M-11, was issued on June 10, 1941. It primarily restricted deliveries by producers. A supplementary order, M-11-a, required producers of zinc oxide and zinc dust to set aside quantities to be delivered as directed by the WPB. Since then amendments and further orders have all tightened the control of this commodity.

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Zinc Stearate

ZINC STEARATE is a fine, white, bulky powder which is insoluble in water, alcohol, and organic solvents, but soluble in acids. It is obtained by the reaction of a soluble zinc compound, such as zinc sulfate, with sodium stearate. United States Pharmacopeial zinc stearate is in reality a mixture of zinc stearate and zinc palmitate, corresponding to not less than 13 percent, nor more than 15.5 percent of zinc oxide. Cosmetic and technical grades are also offered commercially.

In 1939, nine producing plants manufactured 2,035,960 pounds of zinc stearate, valued at $431,226. Output in 1937 by ten plants amounted to 2,073,110 pounds, valued at $421,463. The material is packaged in various sized barrels, 100-pound kegs, 50-pound cartons, and tins and bottles.

Industrially, zinc stearates of varying "flowing" properties are employed as flatting agents in paints and varnishes, in the manufacture of rubber products; and as a waterproofing agent in textiles and cements. In the cosmetic field it finds favor in fine face powders, and in the medicinal field it is an important ingredient of dusting powders, particularly in baby powders since it is mildly antiseptic. The price of both technical and U.S.P. zinc stearates in the first half of 1942 was about 30¢ per pound. At the start of 1941, the technical material was quoted at approximately 22¢ per pound, and the medicinal material 1¢ higher.

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Zirconium

A METALLIC element found in combination only, chiefly in the minerals zircon (zirconium silicate) and baddeleyite (zirconium oxide), zirconium is isolated as a black powder or as a white crystalline powder resembling iron. It melts at about 3000° F., has a specific gravity of 6.4 and has the unique combination of high corrosion resistance and the ability to absorb large quantities of certain gases.

Metallic zirconium is employed as a powder or ductile metal in photoflash bulbs, radio-transmitter tubes, ammunition primers, and other appliances of that type. Below 100° C. the metal is immune to attack by some of the most corrosive agents known. At 500° to 860° C. it can absorb great quantities of hydrogen and at higher temperatures oxygen, nitrogen, carbon monoxide, and other gases. Accordingly, it is particularly suited as a "getter" for vacuum tubes and chemical processes to maintain high vacuum. In steel making, zirconium acts as a scavenger and deoxidizer, removing nitrogen and oxygen as well as nonmetallic substances. In a range of 0.08 to 0.10 per cent zirconium the improvement in grain fineness is marked and above 0.15 percent the combination with sulphur produces a better surface on high-sulphur steels. Cast nickel-silicon bronze and other non-ferrous alloys may benefit by additions of zirconium.

Zirconium, like titanium, when drawn across glass or a glazed ceramic surface, leaves a brilliant, silvery adherent streak. This affords a means of decorating high-grade glassware and pottery without the necessity of using platinum compounds.

In 1940, imports of zirconium ore jumped to 16,845 tons, about half of which was mixed zircon-rutile concentrate from Australia. Chief source of the ore baddeleyite is Brazil but zircon has been found in the beach sands of Florida. Zircon has a melting point of 4000° F. when pure and is the most heat resistant of the commercial refractories. Its use in refractories, specialized porcelains and heat-resisting glass has been growing. It is also the raw material for the manufacture of zirconium compounds, of which opacifiers are probably most important, supplanting antimony and to some extent tin oxide in vitraeous enamels and ceramic glasses. Zircon enamels are nonpoisonous.

The type of baddeleyite of Brazil, known as Brazilite, contains about 80 percent zirconia, while zirconium sand (zirconium silicate) contains up to 66 percent. The coefficient of expansion of zirconia is very low and the material is resistant to acids and alkalies, hence its value in dishes and other articles which can resist sudden changes in temperature.

In the middle of 1942, zirconium powder was priced at $7.00 per pound.

Under WPB Order M-63, as amended June 2, 1942, zirconium ores were listed in Class I. Materials in that class require WPB permission for importation, and sale, processing, etc. after importation, as well as other restrictions.

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